SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII. No. 9. [NEW SERIES.] NEW YORK, MARCH 2, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

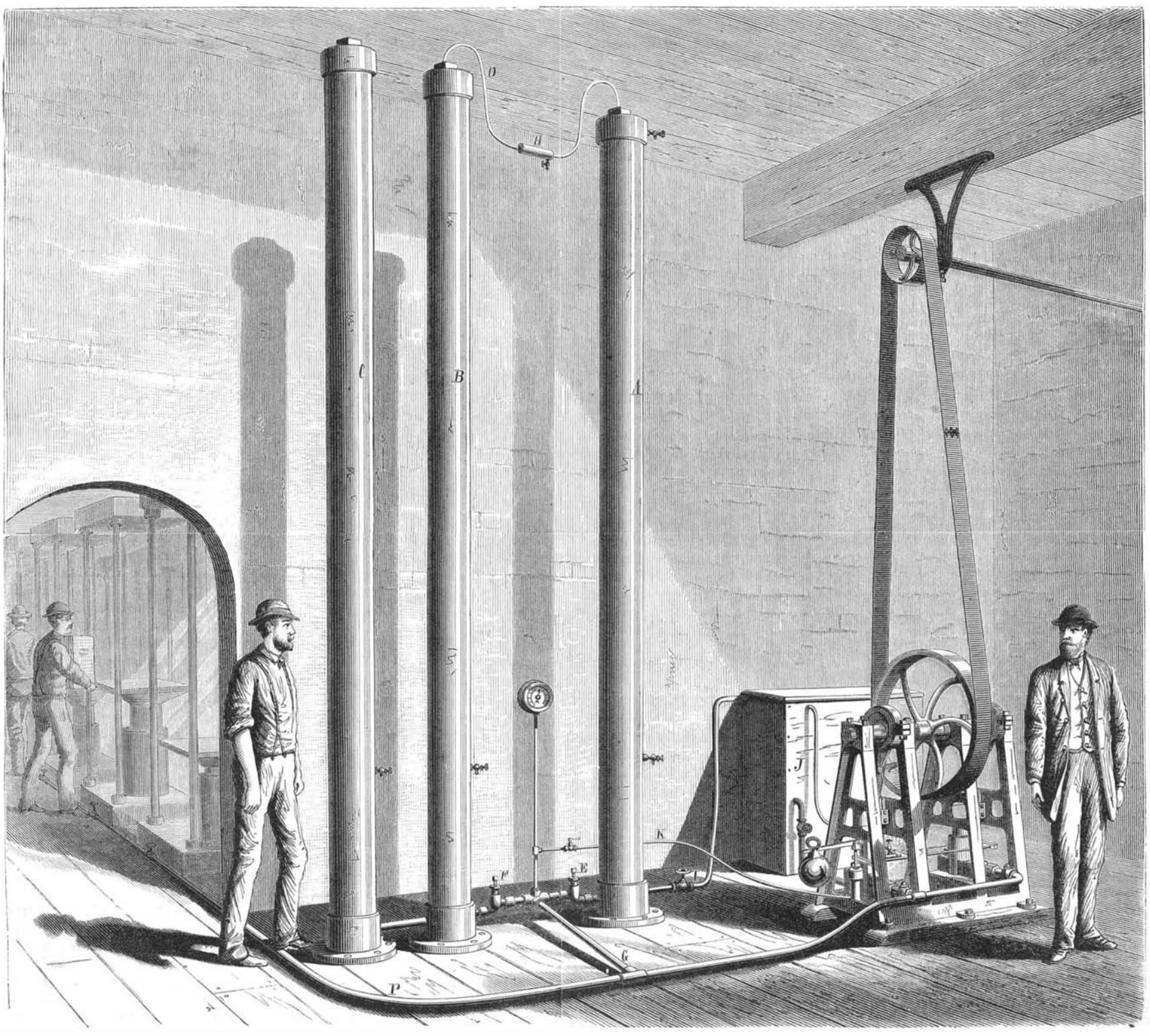
KINNEY'S HYDRO-PNEUMATIC ACCUMULATOR.

We illustrate herewith a new accumulator wherein air is made the reservoir of power. The apparatus is especially adapted for use with the hydrostatic press, in which connection it affords important advantages in economy of power and saving of time. The principal features are the stand pipes, wherein air is confined and compressed by water columns, which water is conducted to the press cylinder and operates the ram. The pumps, which force in the water against the elastic air backing, work continuously until a given water pressure is attained, when, by suitable mechanism, valves are opened which prevent any further delivery, the pumps merely moving the water to and fro without pressure. It will be noticed that this arrangement enables power to be accumulated and stored until wanted, and at the same time obviates the use of the safety valve as a means of relief from over-pressure. The apparatus remains inactive until a portion of the power is expended. Then, when the pressure falls below the fixed point, the valves close and the pumps again operate. Of course the power can be taken from the accumulator as rapidly as may be desired, so that there is no delay for the pump gradually to move the ram; while the action of the pump takes place between the operations of the press, its duty being simply to restore the water in the accumulators which has been used in forcing down the ram. The same water is used over and over again, circulating between a reservoir, the accumulators, and the pump cylinder. Air once compressed in the accumulators is kept there indefinitely, there being no means for its escape. It will be further obvious that the dispensing with the safety valve materially reduces the power necessary to run the pumps, and that the power stored up is susceptible of easy regulation.

In our large illustration, A, B, and C are the accumulators, constructed of wrought iron pipe and securely closed at top and bottom. A and B are connected at their upper ends by the drop pipe, D, and at the lower portions by a pipe containing valves, E and F. To a union between these valves is connected the pipe, G, leading from the pump; and also the small tube leading to the pressure gauge. It is first necessary to charge the accumulators. To this end the stop valve, F, is closed and valve, E, opened. The pump is then set in motion to fill the tube, A, with water. The air from A is thus driven through the pipe, D, into B, so that in the latter it becomes subjected to a pressure of two atmospheres. The stop valve, H, in pipe, D, has sufficient play on its spindle to act as a check valve to prevent reflux of the water. The valve, I, is then opened and the water in A then flows into the reservoir, J. When the tube is emptied the valve, I, is closed and the pump set in operation to force in water into both A and C, until the pressure reaches the maximum required for working. During the last charge sufficient water is forced over the bent pipe, D, to fill both legs and to serve as a seal for the valve in said pipe. The tube, A, then empties of water through valve, I, which is afterwards closed. The stop valves, E and F, are then opened, and the compressed air equalizes itself in the three tubes. The required volume to work the press is then pumped into the tubes, and the relief arrangement is set to prevent the pump forcing any more water until the pressure is reduced. The same method is followed in charging a number of tubes, as the extra ones act merely as an extension of those shown.

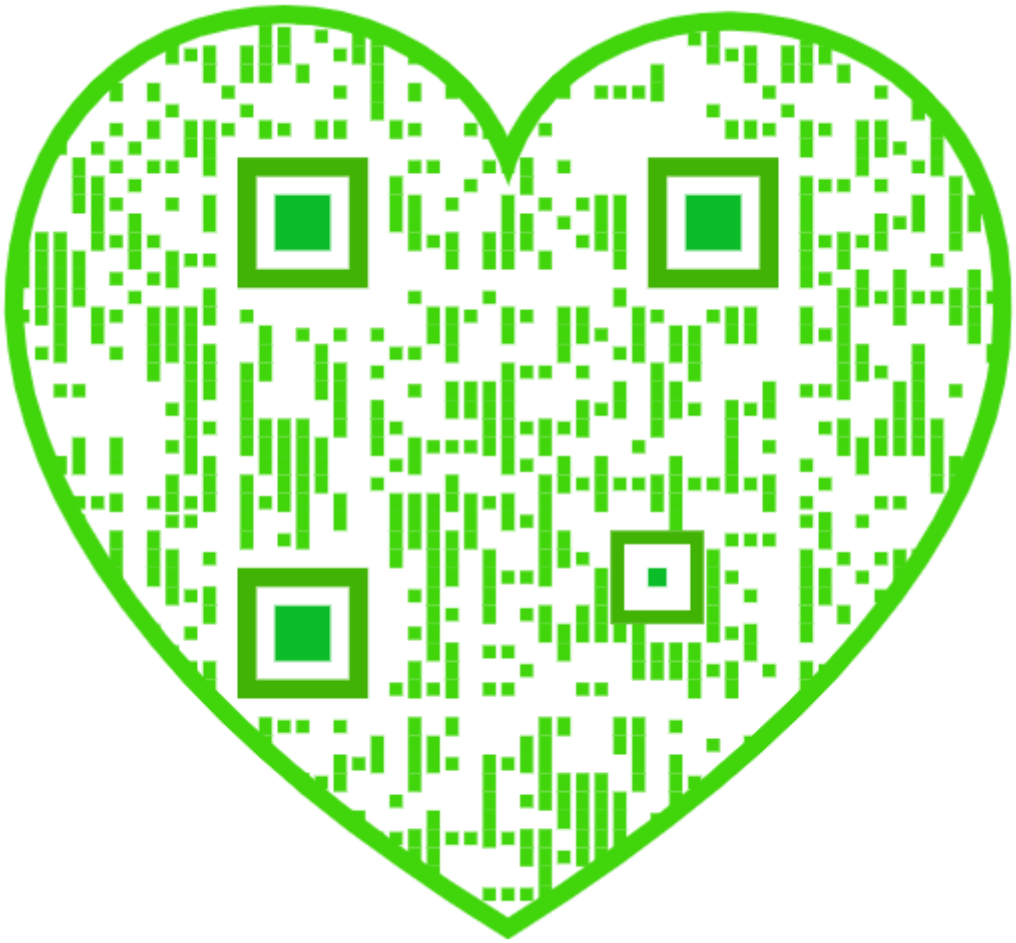
In Fig. 2 is shown a section of the relief mechanism which automatically governs the pumping. Connected with the gauge pipe is a tube which leads to the small cylinder, K, in which is a plunger which supports a weighted lever. By adjusting this weight the plunger may be set to lift at any desired pressure. As the lever is lifted the arm, L, acting upon a projection on the end of a rod, operates the latter so as to open the valve, M. This opens communication between the pump cylinder, N, and tank, J, so that instead of the pump drawing water from the reservoir by the inlet at O, and forcing it to the tubes by an orifice opposite to said inlet, it merely causes a circulation from the tank to inlet, O, thence out at valve, M, and back to the tank. The pumps thus continue doing no work, and hence taking little or no power from the driving engine, until the pressure in

[*Continued on page* 130.]



KINNEY'S HYDRO-PNEUMATIC ACCUMULATOR.

© 1878 SCIENTIFIC AMERICAN, INC



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... **$3 20**
One copy, six months, postage included **1 60**

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter Address MUNN & CO., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

The Postal Union.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4 gold, for SCIENTIFIC AMERICAN 1 year; for both SCIENTIFIC AMERICAN and SUPPLEMENT, $9 gold for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

VOL. XXXVIII., No. 9. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, MARCH 2, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

American manufactures..... 128, 129
Apple worm 138
Arctic expedition..... 133
Astronomical notes..... 138
Barometer, simple..... 135
Book notices 139
Brass plates, casting [30] 140
Bridge over Nile, proposed*..... 135
Business and personal 139
Cement, rubber [23]..... 139
Communications 132
Concrete flooring [34]..... 140
Cornetto..... 136
Cotton seed hulls non-conductor 137
Dentistry, home..... 136
Electrical [5] [8] [10] [12]..... 139
Emery wheels [9]... 139
Fish skins, tanned..... 135
Furnace, the Jarvis..... 136
Gas lighting, automatic*..... 137
Glass, engraving on..... 135, 136
Glass, iridescent..... 134
Glycerin in beer..... 138
Hydro-pneumatic accumulator, Kinney's*..... 127, 130
Industrial notes, foreign..... 135
Invention, conditions of..... 133
Inventions, agricultural..... 137
Inventions, mechanical..... 138
Inventions, new..... 130
Jugglery, scientific..... 129
Larynx, mechanical*..... 136
Lion's destructive apparatus*.... 135
Magnetism [14] [28] [32]..... 139, 140
Metals, tests of..... 132
Meteor, the Virginia..... 137
Microscopical Postal Club..... 136
Minerals, etc 140
Nitro-glycerin 138
Notes and queries..... 139
Optical experiments*..... 129
Paper, Japanese [26]..... 139
Patent No. 200,000 132
Patent office models..... 129
Patents, official list of..... 140
Patents, opposition to..... 128
Pattern work, economy in*..... 133
Phylloxera..... 133
Plumbago as a lubricant [6]..... 139
Prairie chickens in California.... 134
Pumping engine, Rider's*.... 131, 132
Rail puzzle*..... 129
"Scientific American"..... 138
Sewage, utilization of..... 137
Shears and engine, Law's*..... 134
Stains, iron, removing [3]..... 139
Steam engineering, etc..... 132
Stearine pictures 133
Stovepipe expander, Imhof's*.... 134
Tanning, new process..... 135
Telegraph [7]..... 139
Telephone [4] [13] [31]..... 139, 140
Temperature of earth..... 138
Terrestrial magnetism..... 132
Testing apparatus, Bailey's*.... 130
Tinning wire traps [25]..... 139
Turbot and sole for America..... 136
Wall paper, poisonous..... 137
Water pipes, wooden [37]..... 140
Zero [2]..... 139

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 118,
For the Week ending March 2, 1878.

Price 10 cents. To be had at this office and of all newsdealers.

I. ENGINEERING AND MECHANICS.—Compound Armor Plates. Wilson's Plates of Iron and Steel United by Fusion, with Furnace for Making. Sir J. Whitworth's Steel Plates. 8 illustrations.—Improved Fast Torpedo Boats of Messrs. Yarrow & Co., London. Dimensions and working of Launches with speed of 20 miles per hour. 3 engs.

The Destruction of Submarine Cables. Coral Beds, Earthquakes, Submarine Eruptions, and High Temperature on Tropical Coasts, and their destructive effects. Singular injuries made by Sawfish. Extensive damage by the Teredo and other Insects.—Harvey's Improved Torpedoes. 6 illustrations.

Tests of Car Axles. A report to the Master Car Builders' Association by W. E. CHAMBERLAIN. Testing by Etching, with 13 illustrations of Broken Axles. Causes of Hot Journals. How to Test Iron, etc.—The Underground Railways of London.

The Engineering Difficulties and Cost. Length, Course, and Working of the Lines. Dividends, etc. New Line Projected.—Progress of the New Bridge, Poughkeepsie, N. Y. Dimensions and Particulars. Sinking of the Caisson. Direct Rail to the Coal Fields.

New United States Government Rules in respect to Boilers, Boiler Inspection, Stamping and Testing of Boiler Plates, Fire Apparatus, and Boat Lowering Devices and Life Preservers. Instructions to Inspectors and how Boiler Tests are to be Recorded. Requirements of Construction of Boilers. List of Approved Fire Extinguishing, Life Saving, and Boat Lowering Apparatus.—Improved Tube Stopper. 1 illustration.

Nomenclature of Building Stones and of Stone Masonry. A paper read before the American Society of Civil Engineers. By J. JAMES R. CROES, WILLIAM E. MERRILL, and EDGAR B. VAN WINKLE. 18 illustrations of Tools, with best dimensions. Squared, Quarry-faced, Pitched-faced, and Drafted Stones. Rubble. Rough and Fine Pointed Stones. Crandalled, Axed or Pean Hammered and Patent Hammered Stones. Tooth Axed Stones; Bush Hammered; and Rubbed. Diamond Panels. Masonry. Coursed and Uncoursed Rubble; Quarry Pitch; Range; Broken Range; Random; and Ashlar. 16 illustrations of Methods of Dressing. An exhaustive practical description.—The Cariboo Quartz Ledges. The Bonanza and Steadman Ledges, British Columbia, with map and account of claims, and the companies engaged. Astonishing production of Gold. Prospects, Wood, Water, etc. 34 illustrations in all.

II. ARCHITECTURE AND BUILDING.—Examples of Domestic Architecture of France and Italy. 2 illustrations.

III. TECHNOLOGY.—Improved Malt Cleaning Machine, 1 illustration.—The California Petroleum Industry. Enumeration of the wells, their Depth, Cost, and Productiveness. Discovery of New Oil Veins, and Great Excitement.—The Oil Producers' Convention.—New Oil Discoveries in Pennsylvania.—Discovery of Oil in the Black Hills.—Boxwood.—Roofing Paint.—The Limnoria and the Teredo. An Improved Method of Protecting Timber against their Ravages. Description of the insects, with 7 illustrations, and How Piles, etc., may be protected.—Hen Manure.

IV. CHEMISTRY AND MINERALOGY.—Liquefaction of the Permanent Gases.—Iodous Acid.—Edible Clay of New Zealand.—Iridescent Glass.—Bolivite and Taznite.—New Red Coloring Matter from Peach Leaves. By C. BOUGAREL.—Coloring Matter from Velella Limbosa. By A. and G. de NEGRI.—Coloring matter of Boletus Luridus. By G. CUGINI.—Neurine.

Density of Liquid Oxygen.—Oxidation of Iron in a Gas Furnace. By A. TERREIL and DAUBREE.—Oxygenized Graphite and Platinum. By WILLIAM SKEY.—Iodine and Alcohol on the Platino nitrites. By L. F. NILSON.—Davyum. By SERGIUS KERN.—A New General Synthetical Method of Producing Hydrocarbons, etc. By C. FRIEDEL and J. M. CRAFTS.—Determining Vapor Densities. By J. HABERMANN.—Specific Gravity of Iodine Trichloride. By A. C. CHRISTOMANOS.—Pads. By P. TOWSEND AUSTEN.—Solubility of Alkalies in Etner. By WILLIAM SKEY.

Lithium, Cæsium, and Rubidium from Lepidolite. By H. PETERSON.—Magnesium Fluoride. By A. COSSA.—Natural Sulphides. By STAN. MEUNIER.—Manganese Sulphide. By PH. DE CLERMONT.—Retarding Action of Glycerine. By DUNN.—Crystallized Grape-sugar. By HALSE and STEINER.—Optically inactive Sugar. By HALSE and STEINER.—Estimating Bismuth Volumetrically. By M. M. P. MUIR.—Maintenance of Constant Temperatures. By A. D'ARSONVAL.—Albumen in Serum and in Milk.—Gold in Emulsion. By HENRY J. NEWTON.—Rapid Emulsions.

V. MEDICINE AND HYGIENE.—The Morbid Anatomy of Yellow Fever.—Physical Dilation of the Urethra.—Dissection of a Gorilla.—Treatment of Diabetes Mellitus with Salicylate of Soda.

VI. CHESS RECORD.—Biographical Sketch of Eugene Delmar, of New York, with Portrait and one of his Enigmas. Game won by Mr. Delmar.—Problem by W. A. Ballantine.—The Cleveland Voice Problem Tourney.—Problem by S. Loyd.—Enigma by W. A. Shinkman.—Solutions to Problems.—Morality of Chess.

OPPOSITION TO PATENTS NATURAL.

"Hello, Pat! what are you doing there?" cried the driver of a horse car, the other day, to an Irishman at work in an excavation for the new Elevated Railway.

"Arrah, now!" was the prompt reply, "I'm digging the grave of a car driver!"

Ever since the march of improvement began every notable advance in material progress has been the occasion of much grave digging. Materially as well as morally, we rise on stepping stones of our dead selves to higher things. And since vested interests are no more willing to step down and out than are ancient habits or over-lived individuals, it is very natural that there should prevail, especially in circles interested in and dependent upon established conditions, a more or less pronounced objection to the frequent changes incident to rapid progress in material civilization.

When stage lines, with low fares, were first placed upon our streets the prosperity of many worthy people, whose business had been to furnish other means of transit, received a severe check; and it was not surprising that they should look upon the invading omnibuses as little better than public nuisances. But the larger part of the community were benefited by the change, and the improvement carried the day. The parties to the contest changed, but the principle did not, when the street car subsequently crowded out the omnibus.

Each advance in rapid transit only paves the way for one still more rapid; and to-day the contest goes on between the interests vested in street car lines and the projectors of steam roads. What was but lately an innovation, a movement of radical progress, now becomes conservative, and its promoters lustily protest that there ought to be some limit to the mania for speed. Progress was good so long as it was *their* progress; it ceases to be good the moment it builds up rivals and curtails their profits, the demands of the public to the contrary notwithstanding.

Only the other day a new era in the progress of humanity was begun by the invention of what seemed to be the greatest possible improvement in the means of transmitting intelligence. The benefits of the electric telegraph were incalculable, and its cheapness seemed to be surpassed only by its celerity. The business of supplying and caring for telegraphic apparatus speedily became very great and remunerative. But one day a man comes along with a couple of small wooden boxes and a coil of wire; he talks into one box and his voice is heard miles away by whoever will place his ear at the mouth of the other box. Straightway the elaborate and costly machinery of the printing telegraph is, for many uses, antiquated, and the financial grave is dug for many interests vested in the means and methods of transmitting intelligence soon to be largely superseded. That the owners of the old should resent the change is natural; but cheapness and convenience win, and the stream of progress flows on, individual protests being swallowed up and lost in the general acclamation of the community to whose immediate benefit every improvement accrues.

So it ever has been; so it ever must be to the end of time. And the more rapid the progress of any age, the more numerous must be its graves. It is not surprising, therefore, that at a time like the present, when inventors are so active and fertile, there should be a numerous and influential class which feels that after all so much progress may be the reverse of desirable. And since our national patent system has been to so great an extent the mainspring of the rapid changes of recent years, it is not surprising that it should be the subject of no little animosity. It is not surprising either that in so many cases the opposition to patent rights should come from those who have reaped the largest benefits from the privileges they confer. The moment an inventor ceases to invent and becomes a manufacturer and merchant, that moment his interest in patents is completely changed. So far as the patent system conserves his interests and protects him in the enjoyment of his temporary monopolies he can look upon it as a blessing; but it becomes obnoxious just when and so far as it helps to raise up against him a better furnished and more successful competitor. So likewise with manufacturers and special users of patented articles and processes. From their point of view the inventor is a public benefactor so long as they have the exclusive right to control his actions. They are willing that he should be encouraged —until he carries his grist to another mill; then they would suppress him as a nuisance, or curtail his right to the fruits of his own brain, at least so far as to prevent his keeping his inventions away from them.

But these two do not exhaust the parties to this controversy. The largest stake is held by the public at large. By the will of the people the patent system exists neither for the protection of manufacturers nor the rewarding of inventors. It was established rather for the advantage of the whole to accrue from the encouragement of invention and the publication of its results. That this end has been attained by the system to a degree surpassing the most sanguine expectation of its founders is beyond question. That it will be even more beneficial in the future is all but certain, since progress is cumulative and its ratio of advancement geometrical. In the perpetual feud between new and old the nation can take no part. It is a feud which can end only by the cessation of all progress. Secure in the knowledge that the fittest will survive, the nation is therefore willing to let each day's conflict be settled by the inevitable and impartial laws of trade. The livelier the struggle the more rapid must be the progress and the greater the public benefit to accrue therefrom.

AMERICAN MANUFACTURES AND PRODUCE ABROAD.

Mr. Moran, of the American legation at Lisbon, Portugal, writes that our trade with Portugal could be much increased with proper exertions. There is a rich market there for cheap bleached and unbleached cotton cloth for printing, over $3.000,000 worth being imported from England annually to be printed with designs suited to the national tastes. Portugal imports textile fabrics from England to the value of nearly $5.000,000 annually, much the greater part being cotton goods. There is also a good field for American agricultural machines, mill machinery, etc. Sewing machines are now largely sold there.

The American Consul at Rotterdam thinks there will be a large increase of our trade with the Netherlands when the present stagnation ends. The extreme cheapness of Dutch labor allows of the home production of many articles more cheaply than they can be offered by the United States even with the aid of machinery, yet there is already a fair trade in certain special productions of the United States, such as petroleum, tobacco, cotton, corn, rosin, turpentine, and stoves. The imports of Indian corn are rapidly increasing, and if the best modes of utilizing it were more fully known it would rise to a very important branch of commerce. Our cottons are now competing successfully with those of England and France.

From Glasgow our Consul writes that there is a growing demand in Scotland for American machine made wooden ware of all kinds, such as tubs, furniture, brooms, doors, mouldings, casings, etc. He thinks that if our manufacturers were as enterprising in pushing the sale of their goods abroad as they are at home, they could soon secure a practical monopoly of much of this class of manufactures. There is a ready and increasing sale for agricultural tools and builders' hardware, especially locks and hinges. The market for American butter and cheese has fallen off, owing to the inferior quality of some of these goods lately arrived; the superior qualities will always have a good demand. The importation of fresh meats has become an important and permanent feature of trade.

Mr. King, American Consul at Bremen, writes that our manufactures are selling there quite largely. For years past two of the largest manufacturers of mowing and reaping machines have had their European headquarters in that city, and the number of machines sold by these and other similar houses in other German cities has been simply enormous. Several agencies for small agricultural implements and tools have met with marked success; and hundreds of American windmills are replacing those of the ancient style. A significant sale by one American house was a complete outfit of locks for the new post office, where the American system of lock boxes is being introduced. The trade with us in German woolen and cotton goods is much decayed; many houses that had branches in America have been compelled to seek other markets. The Consul thinks that a great trade will eventually spring up for our manufactured articles, but these must be made so as to adapt them to German tastes.

The American Consul at Nuremberg thinks that our trade throughout Germany would be greatly increased if agencies were established for the introduction of our manufactures and produce, which should be conducted by first class business men, and due care taken that the wares placed upon the market are fully up to what is claimed for them. The Consul suggests that leading manufacturers combine and form an association for erecting in Hamburg or Frankfort-on-the-Main an exposition building or American bazaar, as a permanent depot of supply for their staples. Or, if this was found impracticable, smaller associations could be formed by a dozen or so of first-class manufacturers for the sale of staple articles of manufacture.

The report from our Consul at Bradford states that American watches are rapidly displacing the English and Swiss; our agricultural implements and mechanics' tools are of acknowledged superiority; our roofing slates and lumber can be made to supplant those of Norway; the trade in pork and beef is fast growing in importance; that the sale of butter and cheese is astounding, the latter being sold as "Cheshire;" petroleum is a necessary of life; importations of lard, tallow, and eggs are increasing; apples are largely imported, as are also potatoes and dried and preserved fruits. A market will be found in time for California and Pleasant Valley wines, which have an increasing reputation. The Consul thinks that the effect of our duties on wool and dyestuffs has considerable influence in preventing the free competition of our woolen goods in foreign markets, as American wool is lusterless, and the manufacturer must import the raw material and pay duty on it, if he desires to compete in the foreign market for luster goods.

The Consul at Basle writes that since the introduction into the Swiss market a year ago of American canned goods the trade in that article has acquired important proportions. During last November alone there entered Basle about 60,000 pounds of canned beef, ham, and tongue. These products enjoy the highest reputation, and a large increase in their use is predicted.

The Commercial Agent at Gaboon, in Africa, in reporting an expedition he had recently made up the Agowe river, says that the trade of the valley in India rubber, ivory, and ebony is mostly carried on by English and Germans, and states that as the interior of Africa is now rapidly opening and developing valuable resources, it is much to be regretted that American merchants are not taking a larger part of its profitable commerce.

The Commercial Agent at Belize, Honduras, reports that

© 1878 SCIENTIFIC AMERICAN, INC

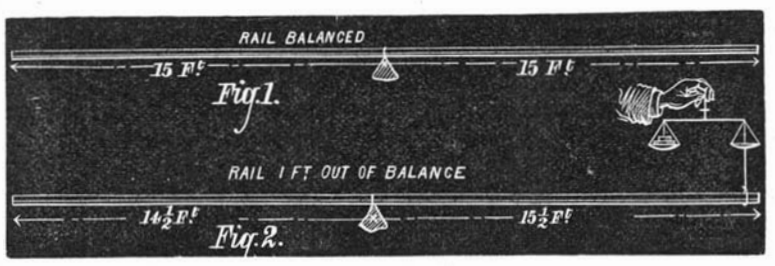
for many years British Honduras has depended wholly upon us for its breadstuffs and provisions, and of late years for most of the articles classed as "groceries." American boots and shoes, kerosene oil, axes, carpenters' tools, shovels, spades, hoes, etc., are much dealt in. The largest article, however, in which there may be an extension of commerce is cotton cloth, which the Consul thinks could be much more largely sold if the pieces were put up in eighteen, twenty-four, and thirty-six yard pieces, and folded in even yards, in the English fashion, as they would be much more convenient for the retailers, who under the present arrangement prefer English goods.

Mr. Osborn, our Minister at Buenos Ayres, writes that the chief obstacle to enlarging our commerce with the Argentine Confederation lies in the absence of direct steam communication between the United States and the ports of the river Platte. No steamers run between the two countries, except an occasional vessel from Buenos Ayres to New York under the British flag, which returns to Buenos Ayres by way of Europe. There are, on the contrary, eleven steamer lines keeping up direct and rapid communication with Europe, of which five are British, four French, two German, and one Italian. As the result of these reliable means of communication the merchants and manufacturers of Europe get nearly all the trade.

THE RAIL PUZZLE.

We have received so large a number of answers to the "practical puzzle" relative to weighing a railroad rail, which we recently published, that we cannot find space even for the initials of the respondents. The problem was as follows:

A civil engineer working on a railroad in Illinois recently had occasion to weigh one of the iron rails. The rail was 30 feet long, and was supposed to weigh about 400 pounds. His only means of weighing was a pair of balance scales capable of weighing only 25 pounds. Query: How can he weigh the rail correctly with such scales?



THE RAIL PUZZLE.

Our correspondents' letters exhibit various methods by which it is proposed to solve the question, but the number of erroneous answers is remarkable. Out of nearly a hundred replies now on our desk, not half a dozen are exactly correct. Some writers neglect the conditions of the problem, and propose to weigh the rail bodily with apparatus made out of planks, or with divisible counter weights, which are manifestly excluded. Those who propose to weigh the preponderance of an unequally balanced rail, either fail to say where the scales are to be attached, an important matter where leverage is considered, or else apply the same wrongly. A large number assert that when a rail that is balanced on its center is moved 1 foot in either direction, the preponderance will be but 1 foot, whereas it is of course 2 feet. Many evidently have the right idea, but express themselves so obscurely as to leave us in the dark as to their exact meaning. Others prefer to view the simple question as a grave mathematical problem, and send us elaborate formulæ, which, while doubtless correct enough, seem ingeniously contrived to befog the whole subject.

Our readers will excuse our failing to make individual reference to their letters, and at the same time permit us to close the discussion with the publication of two correct methods—one by the correspondent who sent us the problem, the other by an old and valued contributor to these columns.

J. T. C.'s answer: The engineer first accurately measured the length of the rail, found it to be precisely 30 feet, and then by measurement found the middle, which he marked. He next laid the iron rail across the sharp edge of an oak fence rail, so that the middle mark rested exactly on the sharp edge. He found that the iron rail exactly balanced on the edge of the fence rail. See Fig. 1. This proved that the iron rail was of equal thickness and weight throughout its entire length. He then moved the iron rail 6 inches, say to the right, of the middle, so that from the edge of the fence rail to the left end of the iron rail would be 14½ feet, and to the right end 15½ feet. Then at 6 inches from the end of the long section of the iron rail, he tied around it a small strong cord. To this cord he attached the balance scales. See Fig. 2. This gave the exact weight of one foot in length of the rail, to wit, 13⅓ pounds, or 40 pounds to the yard in length, which it was contracted to weigh.

F. G. W.'s answer: Place the rail at right angles and horizontally across a delicate support, say the sharp corner of another rail, so that the long end shall weigh just 20 pounds, or some other definite weight within the range of the scales; then divide the whole length of the rail by the difference in the length of the two sections; then multiply the quotient by this weight; the product will be the weight of the rail.

PATENT OFFICE MODELS.

We have before us an argument in favor of the abolition or modification of the patent office model system, prepared by Mr. H. Howson, of Philadelphia, to support a petition in that behalf, which has been signed and forwarded to Congress by numerous patentees and others interested in patents. Mr. Howson is himself a patent solicitor of long experience. That he has carefully studied the question he discusses is evident from the exceedingly able and exhaustive manner in which he marshals his statements, with which probably a majority of our readers will fully concur.

The principal points of Mr. Howson's argument—to which we shall have further reference hereafter—are summed up in the following ten sentences:

First. That it has hitherto been the practice of the Commissioner of Patents, under the law, to demand a model with every application for a patent in which the character of the invention admits of one.

Second. That the making of these models is a serious tax on inventors, involves the premature exposure of inventions, and needless delay in making up applications for patents, and detracts from the revenue of the Patent Office, because the demand for models frequently deters inventors from making applications.

Third. That models are not as a rule necessary for attorneys in preparing applications for patents, or for Examiners of the Patent Office in the performance of their duties.

Fourth. That with rare exceptions complete well executed drawings afford more ready means of determining the character of an invention, and should be, in any case admitting of them, sufficient for the interpretation of the specifications forming part of the patent.

Fifth. That owing to the furnishing of models, there is a tendency in the Patent Office to admit drawings which are wanting in fullness and perspicuity, and which would not be admitted in the absence of models, an evil resulting in the delivery of patents which cannot be easily understood without the aid of models.

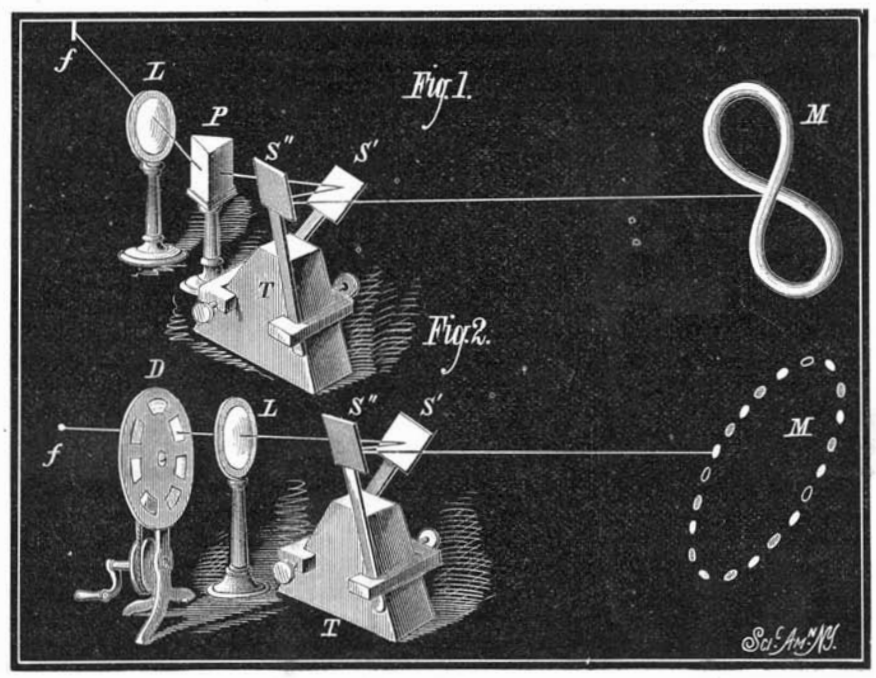
Sixth. That the models deposited in the Patent Office occupy a large amount of space which could be devoted to much more useful purposes.

Seventh. That the increase of models must eventually involve the necessity of either disposing of many of them to make room for the rest, or of finding room for the rapidly growing collection in places outside of the Patent Office.

Eighth. That the models deposited in the Patent Office are rarely working models, but generally fragmentary, and in many cases distorted representations of the machines they are intended to represent, and are consequently unfit for an industrial museum.

Ninth. That an industrial museum worthy of the name can be best established by permitting patentees and manufacturers to deposit at their option and at their own cost properly proportioned and working models of patented machines which have proved to be successful in practice.

Tenth. That ample provision should be afforded to inventors and the public for the examination of drawings of patented inventions.



PROFESSOR RICCO'S NEW OPTICAL EXPERIMENTS.

[For the Scientific American.]

TWO BEAUTIFUL OPTICAL EXPERIMENTS.

BY PROFESSOR A. RICCO, OF NAPLES.

A ray of sunlight entering a dark room horizontally through a little vertical slot, *f* (Fig. 1), passes through a converging lens, L, and then through a prism, P, after which it falls upon a little mirror, S′, whence it is reflected to a second mirror, S″, which, in turn, throws it upon a white wall, M. The lens and the prism should be so adjusted that a solar spectrum not large but quite brilliant may be obtained upon the wall, M. The two little mirrors are fastened to two vibrating springs inclined 90° to each other, and each 45° from the vertical. These springs are secured to a firm support by means of screw clamps. By changing the position of the clamps, the rate of vibration of the two springs may be varied at will.

If the springs vibrate almost in unison, there will appear on the wall a magnificent ring composed of the colors of the spectrum, which will seem to rotate about its axis and about its diameters, assuming successively the forms of an ellipse, of a circle, and of a right line.

If the springs vibrate as octaves, we shall have upon the wall, or screen, an oscillating variegated figure 8. If the ratio of their vibrations is less simple, we shall obtain a great variety of complex curves resembling the intertwining of variegated ribbons; in a word, the beauty of the well known curves of Lissagous is here enhanced by the splendor of the rainbow colors.

If, instead of using the prism, we substitute a revolving disk, D (Fig. 2), containing little windows made of colored glass, the above curves are broken up into a series of elegant little disks of various colors, resembling necklaces of brightly colored gems intertwining with rapidity.

The same effect is produced by looking through this revolving disk at the colorless curves of Lissagous.

SCIENTIFIC JUGGLERY.

We have often thought that if professional conjurers would substitute for such time honored tricks as making omelettes in hats, and causing cards to appear and disappear, some of the wonder working performances of the electric current, they would succeed much better in mystifying, amusing, and perhaps instructing their audiences.

Mr. Heller, a clever magician now performing in this city, has a neat way of bringing the electric current to his aid where it would hardly be expected. For example, after borrowing a few watches he places them on a plate which he suspends by a bit of string to a little bar between two cords from the ceiling. Suddenly a flash comes from the bar, the string is burned, and plate and watches fall with a crash. The broken plate and ruined watches are restored by shooting them out of a gun, against a framed black square, also suspended by cords from the ceiling, and here again the electric current actuates mechanism which causes the lightning-like disappearance of an interposing screen. The current again works the hammer of a glass bell apparently suspended by a mere thread, but which accurately counts the number of spots on chosen cards. In electro-music Mr. Heller is an adept. He has a dozen or more drums which he heaps up on a kind of barrow in the middle of his stage. Then seating himself at his piano, at some distance away, he plays a lively air, to which the mysterious drums at first beat time, and then play a deafening accompaniment. Of course, concealed hammers operated by electro-magnets are at the bottom of the puzzle. The Heller orchestrion is a much more elaborate contrivance. It is a good sized parlor organ, provided with a supplemental keyboard, and surmounted with a bewildering mass of brass tubes and apparatus. An air played by the performer is suddenly accompanied by a chime of large bells at the further end of the hall, then by small bells near by, then another organ near the ceiling issues notes like a flute, a chorus of sleigh bells in still another part of the hall joins in; the music imitates a storm, and a huge iron plate in another quarter rattles itself, while from a box near the ceiling issues the sound of falling rain. Finally two sharp explosions from miniature guns near the roof are heard, the lights are turned down, and on the organ appear revolving Geissler tubes, flashing out green and blue light in the weirdest manner, as the curtain shuts the magician and his instrument from view.

He also shows a number of other ingenious illusions, some of which depend upon remarkable automata and many upon electrical action. Upon a simple trapeze suspended from a bar over his stage, he seats a doll dressed as a gymnast. The trapeze is set oscillating, and thereupon for some ten minutes the doll goes through a series of performances, the very variety of which baffles all theories as to how the figure is worked. The hands alone touch the trapeze bar, and the mechanism in the body is necessarily governed through the ropes and cross piece; but it is not so easy to explain how, in concluding, the figure lets go with its hands, throws a somersault, and catches on its toes, continuing the swinging in that position. Another automaton is a peacock, which cries, moves its head, eats, and spreads its tail at the order of the conjurer. Still another is a doll which emerges from a box, seats itself on the edge, goes through many laughable antics, and ends by smoking a pipe, puffing forth the smoke in the most natural manner.

ONE portion of the Gilbert Elevated Railway, between Worth street and 42d street, New York city, 3 miles in length, is to be opened for traffic March 1. The rails are now laid and the stations are in progress.

© 1878 SCIENTIFIC AMERICAN, INC

BAILEY'S TESTING APPARATUS.

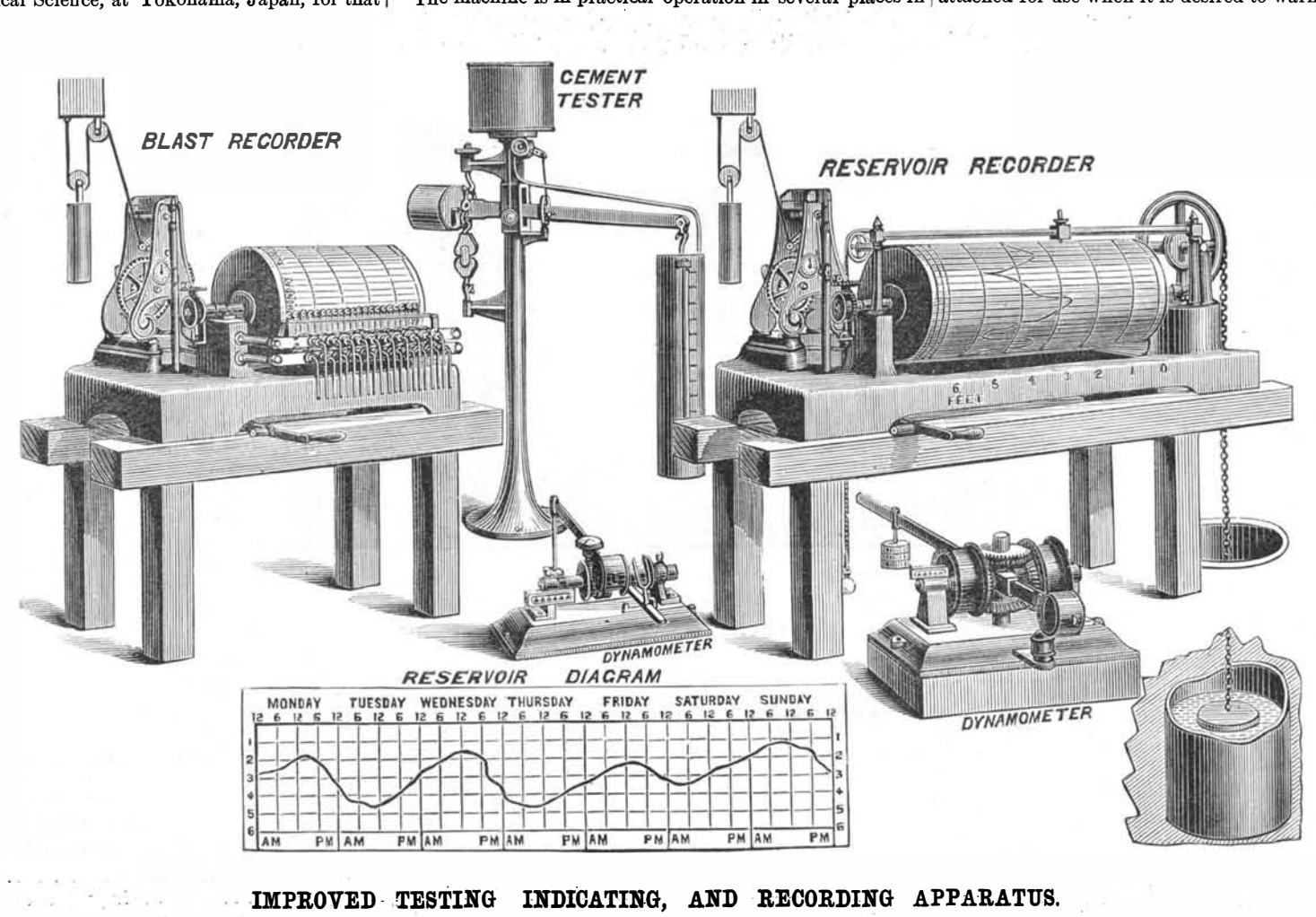
The accompanying illustration is taken from a photograph of a set of testing, indicating, and recording apparatus recently constructed by Messrs. Bailey & Co., Salford, England. This apparatus covers a diversified field, as will be seen from our description, and yet there is a certain similarity of principle which appropriately groups the several members of the series together.

The reservoir recorder is one of a number made to indicate the fluctuations of the water in the reservoirs of the Sheffield Water Works, and in connection with the other instruments has been described in the *Engineer*. The drum performs a revolution once a week, being driven by a small turret timepiece, strong enough for the purpose, and the clock beats seconds. A friction clip in connection with the set dial enables the drum to be set to the true time without difficulty. The diameter of the drum is 12 in., and its length is 3 ft., a fluctuation of 6 ft. being recorded, thus giving a scale of 6 in. to a foot. This reduction of scale is obtained in a very simple manner, the float pulley upon which the chain is fixed being double the circumference of the pulley which actuates the pencil, and which is guided by the two horizontal brass bars over the top of the drum, in order to prevent any possible error from backlash of the mechanism, or by wear and tear in the ordinary course of use. The float, it will be observed, is balanced by a small weight attached to a chain, which is fastened to the pencil block; this enables a very sensitive diagram to be taken. The illustration at the bottom of the engraving shows a diagram, which will scarcely require any further explanation.

Somewhat similar in design is the recorder for indicating the blast of smelting furnaces, in the left hand corner of the engraving; the dimensions of the drum and of the timepiece are similar to the reservoir recorder, but the instrument has been constructed for a different purpose. The improved hot blast fire brick stoves now used for heating the air used for the blast furnaces are worked intermittently, and the results depend a very great deal—in fact, we may say altogether—upon the regularity of the performance and punctuality of the men who have charge of them. This will be understood by those engaged in blast furnace operations. In a very simple manner each blast furnace has its performance recorded upon the revolving diagram. In all, the performances of twenty-one engines are indicated and recorded upon the drum. Each engine has its own separate and independent pencil, which records its performance on the paper, and this is done in the following manner: A pipe leading from the blast pressure terminates at a cross bar opposite the drum, to which the pencil mechanism is fastened; when the blast comes on a small piston is caused to project forward forcing the pencil upon the paper; the joint is made air-tight by means of an elastic diaphragm, about an inch in diameter. There are means of adjustment and other details which have required great care in their development, and to which it may not be necessary to refer. As the diagram makes a revolution once a week, it will be apparent from our description that the number of hours worked by each blast engine can be at once seen by the length of the stroke which its pencil has made upon the paper. By then comparing the number of strokes made per minute, or per hour, by each engine, important calculations may be made and statistics obtained which will bear upon economy of manufacture.

We also illustrate a set of machines made for the Imperial College of Physical Science, at Yokohama, Japan, for that Government. In the background is shown a cement tester. Most testers for this purpose have faults which interfere with accuracy, owing to the vibration which is imparted to the machine during the process of testing, as extra weight and strain are being put upon the material under tests. Sometimes it is done by a screw which lifts a lever, and sometimes by means of a movable weight which slides along a lever, similar to small weighing machines. This machine, which is called hydrostatic, has the weight—which consists of a long can into which a small stream of water flows—placed at the end of a lever; this enables the test to be applied in a very gradual and nearly imperceptible manner, without any vibration; in fact, the operator may sit down and watch the machine after the tap has been turned on until the fracture is effected. The height of the water in the cistern is indicated by means of a glass tube, similar to the water gauge glass of a steam boiler, the graduation being painted down the can or cistern. When the material is broken a small trigger closes the tap and prevents any further supply of water.

The instruments in the foreground consist of a Prony dynamometer for indicating the power exerted to drive small machines; weights are placed upon a lever which acts upon a friction brake; the revolutions are counted by means of a small compact friction brake dynamometer. The larger one is the bevel wheel dynamometer, which will indicate the power exerted by machines up to four horse power.



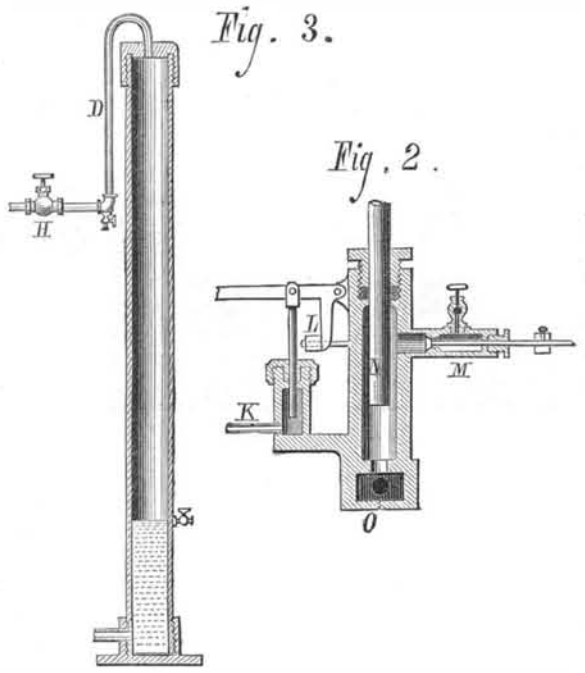
IMPROVED TESTING INDICATING, AND RECORDING APPARATUS.

KINNEY'S HYDRO-PNEUMATIC ACCUMULATOR.

[*Continued from first page.*]

the tubes falls below the regulated point. This is caused by the drawing off of water for use in the press by the pipe,

Fig. 3.



KINNEY'S HYDRO-PNEUMATIC ACCUMULATOR.

P; and this water, after acting upon the ram, is led back to the tank, J.

It will be clear that the operation of pumping to replace the power drawn off takes place while the press is not in action, so that this interval is turned to useful account, the work of the pump supplementing, as it were, that of the press. The apparatus is excellently adapted for use in connection with cotton presses, owing to the economy of time effected. Any number of presses can be operated from suitable apparatus of this kind, the workman in charge of each managing his press independently of the others; or a press having a long stroke can be caused to work instantly at any speed and with safety.

The machine is in practical operation in several places in this city, and may be seen at 141 West Broadway. For further information address the inventor, Mr. F. S. Kinney, 141 West Broadway, New York city.

New Inventions.

An Antiseptic Powder, invented by M. Fabien Jourdes, of Paris, consists of equal parts of bisulphate of alumina and potash, or alum, pure sulphate of lime, and biborate of soda, or borax, to be used dry or in solution.

An Awning for show windows has been invented by Mr. Edward De Courcy, of San Francisco, Cal., by which the light may be admitted at the top and shut off wholly or in part, thus enabling goods to be shown in strong light, or protected from it. This awning is hung and raised or lowered in the usual manner, but at some distance below the top of the window, the space thus formed being opened or closed by an extension of the awning, which winds upon a roller suspended from the top and capable of being raised or lowered.

An improved Sewer Trap, designed to prevent the flooding of cellars by back water from sewers, has been patented by Messrs. W. Torney and C. N. Tillotson, of Detroit, Mich. In the trap is a hinged float valve, of hemispherical shape, the upper flat face of which is lined with rubber or other packing material. When this valve is lowered, or in open position, the water passes freely from the drain pipe through the trap and into the sewer pipe; but when backwater enters the trap the valve is raised, closing the drain pipe, and thus preventing the water from rising.

A Medicated Suppository, composed of slippery elm bark, sassafras, Dover's powder, and extract of valerian, has been invented by Mr. F. D. Owen, of Joplin, Mo.

Mr. Geo. W. Cummings, Jr., of Big Rapids, Mich., has invented an Oscillating Chair, in which the legs are stationary, and the seat is connected with them by curved springs, which pass from the rear legs to the forward part of the bottom of the seat, and from the front legs to the rear portion. The springs cross each other, and are so secured by clamps to the legs and by screws to the seat as to prevent lateral motion.

Mr. H. M. Farnam, of St. Albans, Vt., has invented an improved Ventilator, consisting of a casing with a screened supply pipe and adjustable doors, and a curved exhaust pipe and damper above the supply pipe. The exhaust pipe is also provided with a compound cap, for preventing the entrance of rain or snow and for keeping up the draught.

A Process for Treating Paper Boards so as to render them waterproof and give them the appearance of wood has been patented by Mr. Chas. Hansen, of Ebeltoft, Denmark. The object is to make a paper panel to take the place of wood, and the process consists in impregnating the paper with oil having a small quantity of drier, and afterward compressing and drying the boards.

An improvement in Corset Springs originates with Mr. Joseph Day, of Brooklyn, N. Y. It consists in a broad stay with fixed hooks, and an overlapping stay with hinged eyes, made of one solid plate of metal, with an extension projecting beyond the point of the hook, so as to be readily taken hold of for opening or closing.

Mr. Joseph F. Rose, of Tiverton, R. I., has invented a Night Chimney, or cylindro-conical case containing a chimney, which has an opening through its side and a slide door, and is fitted to the lamp burner by a cylindrical collar. The top is removable, and supports for holding a vessel can be attached for use when it is desired to warm a fluid.

A Truss and Supporter, invented by Mr. A. M. Dye, of Elkhart City, Ill., has a pad, consisting of a number of spheroids of soft rubber, strung on cords and contained in a flexible bag, and the supporter is a U-shaped stem and cup, all being arranged in a novel manner.

Mr. J. D. McLinden, of New York city, has patented a Ventilating Flue Cap, which revolves with a vane, and has a shield on the windward side to prevent the air from entering on that side, while flanges attached to the pipe deflect the air from other parts, thus preventing downward currents.

© 1878 SCIENTIFIC AMERICAN, INC

RIDER COMPRESSION PUMPING ENGINE.

The fact that so many of these engines are in successful operation throughout this and other countries is the strongest evidence of their utility and of the public favor with which they are received. Symmetrical in appearance, constructed with great care, and exhibiting superior workmanship, valveless and noiseless, simple, safe, economical, and efficient, it is not surprising that they are in constant demand for various purposes where limited power only is required. Hence they are found especially serviceable on railroads for filling water tanks; in public buildings, hotels, universities, asylums, city and country residences, and all descriptions of manufactories; for irrigation purposes; in short, wherever a small, neat, compact motor is required.

Atmospheric air is the only agent employed to obtain motion, and as the name implies, this is compressed. No steam whatever is used, hence its great safety and simplicity. There are no separate boilers, tanks, reservoirs, or pipes connected with this description of engine, neither has it any working parts exposed to the action of the heat. Reference being made to the annexed engravings, the arrangement of the mechanism and the *modus operandi* will be readily understood. Fig. 5 represents the engine complete in working order, and serves to give a good idea of its general exterior appearance, and how free it is from all complication. Fig. 6 shows a partial vertical section, and to it particular attention is called, as from this view the construction will be easily comprehended. A is a compression cylinder, B a power cylinder, C D the pistons of the cylinders and connections, and H a regenerator. The lower portion of the compression cylinder, A, is kept cold by a current of water which circulates through the cooler, E, that surrounds the lower portion of the cylinder, while the lower portion of the power cylinder is kept hot by the action of the fire below the heater, F. G is a thin telescopic iron cylinder within the heater, F. I I are two cranks which stand at an angle of about 45°, J J connecting rods, K K packings which are in duplicate for each cylinder. L is a simple check valve which supplies any slight leakage of air that may occur.

The operation of the engine is briefly as follows: The compression piston, C, first compresses the cold air in the lower part of the compression cylinder, A, into about one third its normal volume, when, by the advancing or upward motion of the power piston, D, and the completion of the down stroke of the compression piston, C, the air is transferred from the compression cylinder, A, through the regenerator, H, and into the heater, F, without appreciable change of volume. The result is a great increase of pressure, corresponding to the increase of temperature, and this impels the power piston up to the end of its stroke. The pressure still remaining in the power cylinder and reacting on the compression piston, C, forces the latter upward till it reaches nearly to the top of its stroke, when, by the cooling of the charge of air, the pressure falls to its minimum, the power piston descends, and the compression again begins. In the meantime the heated air, in passing through the regenerator, has left the greater portion of its heat in the regenerator plates, to be picked up and utilized on the return of the air towards the heater.

Fig. 5.

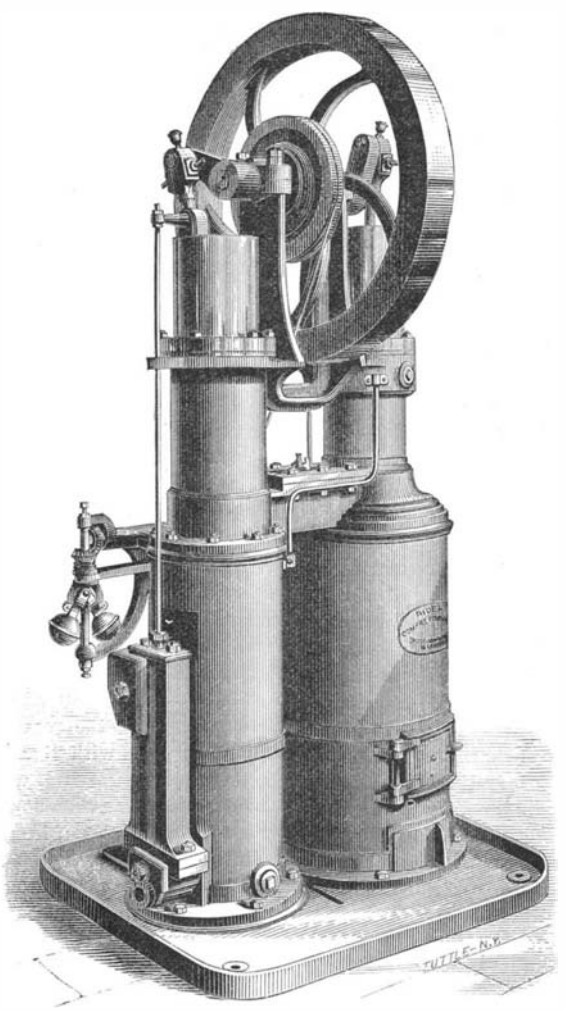
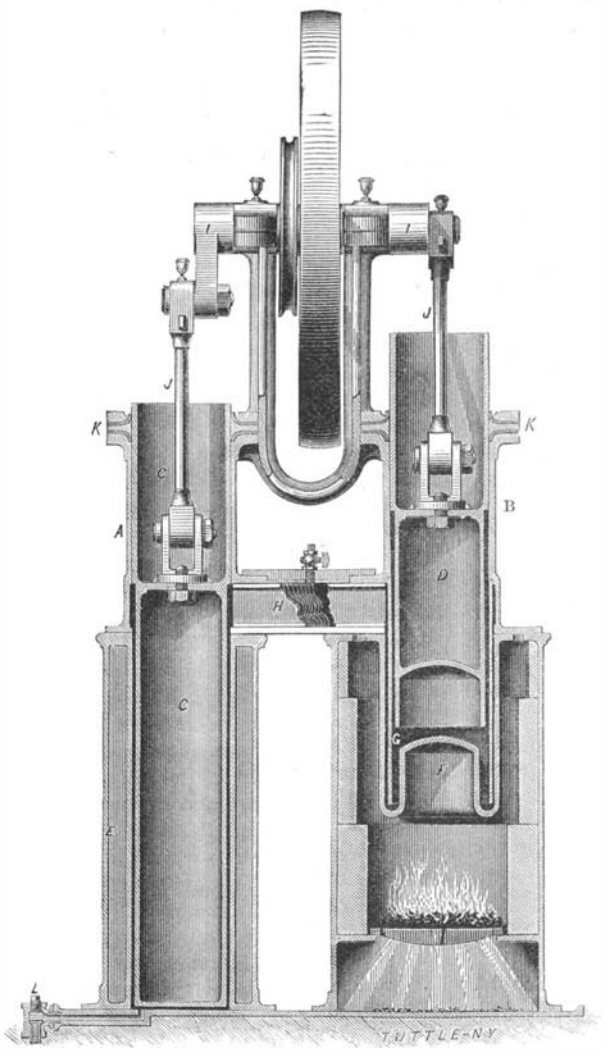


Fig. 6.



THE RIDER PATENT COMPRESSION HOT AIR PUMPING ENGINE.

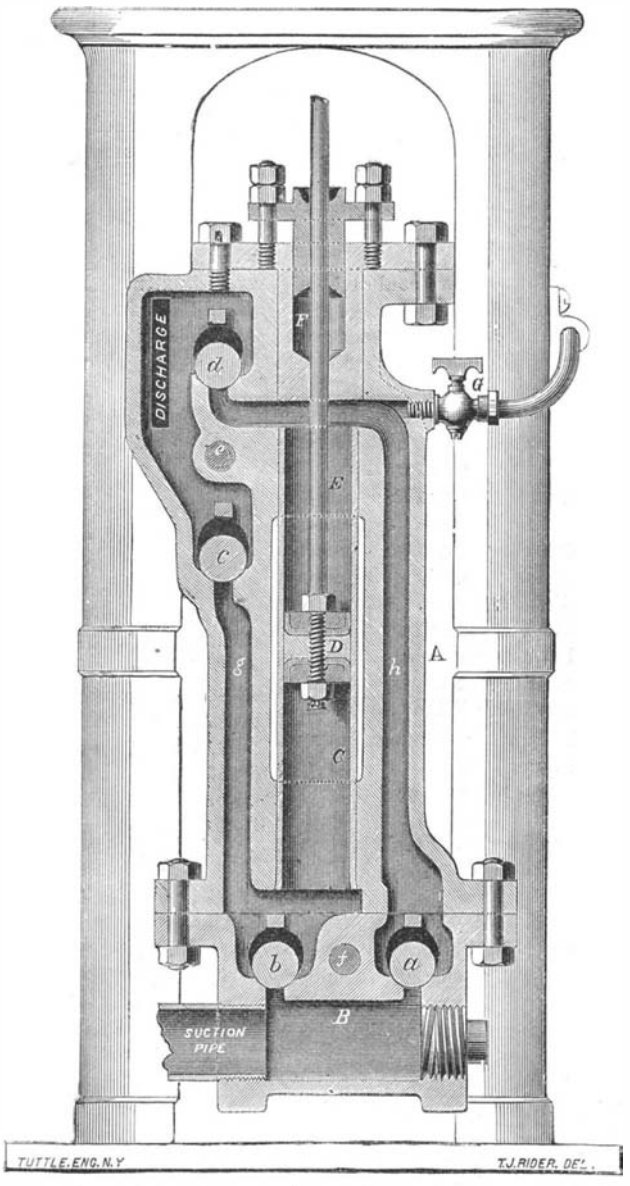
The construction and operation of this compression engine being understood, it will be readily seen how well adapted it is for pumping purposes. This is illustrated in Fig. 1, where an engine, drawn to a small scale, is shown attached to a deep well pump. Figs. 2 and 3 are sectional views representing the interior arrangement of the pump mechanism. In Fig. 2, A is a brass pump barrel, B pump case, D air barrel, E water pipe connecting pump to stuffing box, *c* suction valve, *b* delivery valve. In Fig. 3, A is a brass pump barrel, C pump bucket, E E water pipe, F F connecting rod or plunger, G stuffing box attached to engine, H solid end of plunger attached to compression piston.

The operation of this pump is as follows: On the ascent of the bucket the water enters the strainer at the bottom, raising the suction valve, *c*, and fills the barrel, A, from below. On the downward stroke of the bucket and the consequent closing of the suction valve, *c*, the water in the barrel, A, will be forced through the circle of holes in the lower flange of the case, B, passing upward between the exterior of the barrel, A, and the interior of the case, B, through the circle of holes in the upper flange of the case, raising the delivery valve, *b*, and following the course of the bucket downwards so as to fill the upper part of the barrel, A; but as only one half the quantity of water displaced by the descent of the bucket can re-enter from above, owing to the space occupied by the plunger, one half will flow up the discharge pipe, E, the remaining half ascending on the up stroke of the bucket, thus making the pump double-acting above the bucket and single-acting below it. The advantage of keeping the long liquid column in continuous motion is thus fully gained; and the result is a smooth and economical operation. It will be observed that the bucket can readily be withdrawn, when necessary to replace the cup leather, through the discharge pipe and stuffing box without removing either from the engine.

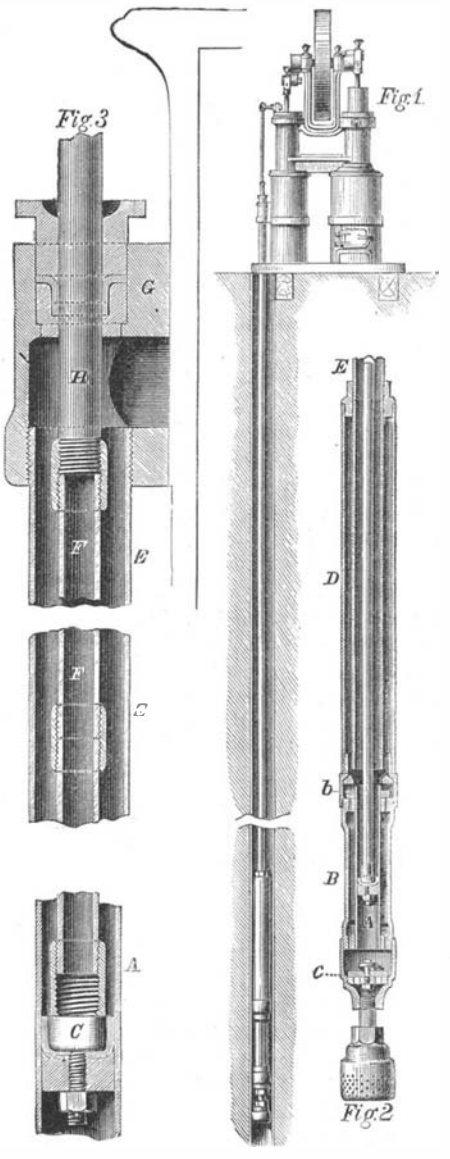
These deep well pumps are especially adapted for artesian or tubed wells, being made cylindrical for this purpose. They can be inserted in tubed wells of five and six inches in diameter, and are very valuable for irrigating lands, draining marshy places, quarries, pumping bilge water, etc.

Whenever water is not over from 20 to 25 feet below the engine, a rolling valve pump is furnished. This is bolted to the side of the cooler and worked directly from the compression piston, and all the water is passed directly from the pump through the cooler on its way to the tank or outlet, making a very complete arrangement. Fig. 4 shows a sectional view of this pump bolted to its place on the cooler. It will be seen that the pump is made in two pieces. The upper or main part, A, contains the delivery valves, *c d*, and also the barrel, C, which is a seamless drawn brass tube securely fitted and expanded therein. The lower chamber, B, to

Fig. 4.



THE RIDER ROLLING VALVE PUMP SHOWN BOLTED TO COOLER OF ENGINE.



RIDER DEEP WELL PUMP IN SECTION.

© 1878 SCIENTIFIC AMERICAN, INC

which the suction pipe is attached, contains the suction valves, *a b*, and is bolted, as shown, to the main part. The bucket, D, is provided with two reverse cup leathers. The rod, E, passing upward through the stuffing box, F, is connected to an arm on the cold piston, as may be seen in engraving of engine, Fig. 5, page 131. The priming cock, G, is connected with the cooler by a small pipe, and is for the purpose of priming the pump by water from the cooler, and thus allowing any air to escape that may be trapped in the upper part of the passages. The pump is held to the cooler by two bolts, *ef*, which are long enough to go through and secure the bonnets over the valves.

The operation of this pump is as follows: Assuming the bucket, D, to be at the bottom of its stroke, on its ascent the water is drawn in through the suction pipe, raising the valve, *b*, and filling the pump barrel, C, from below. On its descent the bucket forces the water which is below it out of the barrel through the passage, *g*, raising the delivery valve, *c*, and through the discharge opening into the cooler, and at the same time fills the barrel from above by drawing the water through the passage, *h*, past the suction valve, *a*. This water is forced upward on the ascent of the bucket, raising the delivery valve, *d*, and passing through the discharge opening as before.

The valves are simply cylindrical pieces of rubber, very durable, and easily accessible by removing the bonnets. This construction of valve obviates the necessity of bridges or grating in the valve seat, and allows the port to be one free opening, with nothing to obstruct or impede the passage of the water.

Here, then, are two kinds of pumps operated by a simple, inexpensive, compact motor, automatic in its character, one adapted for supplying water to railroad stations and public buildings, and another for pumping from deep, artesian, or tubed wells. For instance, the engine may be placed at a distance from a country residence and draw its supply from a well. The water can be forced up to the house, probably a quarter of a mile distant, and up an elevation of 100 feet or more. Or it can be applied to the irrigation of gardens or fields in dry and hilly countries; as, for example, in the orange and lemon gardens of Spain, France, Italy, etc.; or, again, to the operating of a punkah in bungalows and pumping water for baths. The Rider compression pumping engine, during the last summer, did good service in the Floating Hospital, St. John's Guild, New York. It is in operation on estates owned by some of the English nobility, and on several of the principal railroads in England and this country. Besides several other medals, a prize silver medal was awarded it at the meeting of the Royal Agricultural Society, at Birmingham, England, in 1876, and it received one of the highest awards at the Centennial Exposition in Philadelphia.

Silver medals were awarded by the Cornwall Polytechnic Society, the Worcestershire Agricultural Society, Kidderminster, England, and a diploma of honor was also awarded at the Antwerp Exhibition.

One of the best features about the Rider hot air compression engine is that it can be cared for and tended by illiterate persons or by women and boys; putting in a little fuel occasionally, and oiling, being the principal duties to perform.

The engine can be seen in operation at the warerooms of Messrs. Cammeyer & Sayer, 93 Liberty street, in this city, who state that these engines and pumps are strictly American inventions, and that there are five hundred in operation in America, sixty in New York city alone, and two hundred in Europe and India.

Promoting Steam Engineering and Iron Ship Building.

Mr. Shellabarger has introduced a bill into the House of Representatives designed to promote a knowledge of steam engineering and iron ship building among the young men of the United States. It provides that the President, upon the application of any established college or scientific school in the United States, may detail an officer from the engineer corps of the navy as professor in such school or college, provided that the number of officers so detailed shall not at any time exceed fifteen, and such details shall be governed by rules prescribed by the President; and provided further, that such details may be withdrawn or withheld whenever the President thinks the public service shall so require. There is a similar law relating to details from the engineer corps of the army, which has been found to work well, and the present bill is approved by the professors of the Naval Academy. There is generally considerable unemployed talent in the naval engineer corps which could be detailed without additional cost to the government, to the great advantage of the young men of the country and to our merchant marine.

Tests of Metals at the Navy Yards.

The Secretary of the Navy is making a careful test of some specimens of iron manufactured in the navy yard at Washington, and is investigating the question of the cost of fitting up the necessary smelting apparatus there for the purpose of making iron both from scraps and ore. There is a vast accumulation of scrap iron yearly at all the navy yards which is said to be usually sold at about one tenth its value, and which might be readily utilized if the necessary furnaces were erected.

The Secretary has also ordered tests to be made of a new composition which the inventor claims will neither corrode nor change its color, and which is almost the hue of gold. It is claimed that it can be substituted for sheathing copper with great advantage, as it is many degrees lighter than copper; that it can be utilized for a vast number of purposes on shipboard where other metals cannot be so well used, as the composition will always retain its bright, rich appearance.

The inventor has submitted to the Secretary a number of manufactured articles of this material, and also metal in the rough, which has been sent to the navy yard for the purpose of seeing whether it will come up to what is claimed for it as a valuable material for ship use. Its comparative cheapness, in case it proves useful, will make it a desideratum in the construction and sheathing of vessels.

Communications.

Terrestrial Magnetism.

To the Editor of the Scientific American:

Allow me to offer you the details and results of some experiments which I made recently, and which, so far as I have been able to ascertain, are new.

By way of introductory remark, I may say that about twenty years since, in a work entitled "Key to the Geology of the Globe," I endeavored to show that the trends and main mountain ranges of our continents bear a direct relation to certain phases of the ecliptic, being usually secondaries, or, in other words, at right angles to the sun's apparent path at the solstices, thus forming angles respectively of about 23° or thereby with the meridians. These trends therefore correspond in the main to the position assumed by the needle at its extreme secular east and west elongation, as far as we can judge from the magnetic observations made at Paris since 1580. The magnetic phenomena are now generally supposed to result from the effect of strong thermo-electric currents passing from east to west, between the tropics, along the apparent path of the sun.

As solar energy in some of its modifications appeared to me, by reaction from the earth's interior on its exterior crust, to have an intimate connection with dynamical geology, and hence possessed great interest for me, I have, during the twenty years above alluded to, been devoting such time as I could spare from my collegiate duties to terrestrial magnetism in connection with physiographic and dynamical geology.

Just before the Buffalo meeting of the A. A. A. S., I had sent in the title of a paper which I had prepared, and intended to read, on this subject; but in consequence of a sunstroke I received I had to withdraw it. Since then, having recovered sufficiently to engage in some original experiments during my vacant hours, I gave some account of them in six communications, to be followed probably by two more, to the Indianapolis *Daily Journal*. Inasmuch, however, as that journal may probably fail to reach some scientific men who might feel an interest in these results, I offer you the following synopsis of the more recent experiments and results:

Using a delicate galvanometer, accurately adjusted, and the necessary amount of insulated fine copper wire for making the attachments, and being kindly aided by Mr. Brown Wylie, of the physical department, we drove iron rods of ¾ inch diameter six feet into the ground. On the upper end of these I had had good sized eyes formed at the blacksmith's shop, so that with a round wooden lever inserted in the eye, and a few blocks as a fulcrum, we could take the rods up, in order to drive them again elsewhere. Sometimes these rods were driven due east and west of each other, at other times due north and south, at from 100 to 200 feet apart, while the insulated wires, firmly attached respectively to the two rods, were brought through the open windows of the museum, where, as that is under my charge, the galvanometer could be undisturbed. Being careful previously, by means of a battery, to ascertain which way the needle was deflected by a known current (as for instance, from the carbon pole of the potassium bichromate battery) connected with a given binding screw, we could then be quite certain as to the direction of the so-called current transmitted from the iron rod or other material along either wire.

In this way we experimented at different hours of the day, and during varying weather on different days; we also attached one wire sometimes to an iron oil tank sunk six or eight feet under ground in the campus; at other times we formed wire connection with a water tank having a cast iron collar. We also sometimes connected one wire with the lightning rods or metallic gutters and spouts, and occasionally brought one wire from the underground tank, while the other was attached to an iron column above ground in the museum. The results of these experiments may be thus summed up:

1. Whenever both wires connected with underground objects north and south of each other, the current was invariably from south to north and usually strong, making a deflection of the needle, after breaking and connecting a few times, of at least 90°.

2. When the rods were east and west of each other the current was from the west, but comparatively weak, as high, however, sometimes as 45°.

3. When we experimented with a long cast iron fence, open in center, placing the galvanometer and its wires in that central space (in which case the connection with the earth's crust was made only by the stone pillars to which the iron pillars of the fence were riveted), then the result showed currents from the south.

4. But when we brought one wire from an underground metallic source, and the other from a metal pillar, stove, fence, or the like *above* ground, then the current, as far as yet tried, was from the atmosphere to the earth.

The above experiments would seem to justify the conclusion that these electrical currents in the earth's crust are due to the thermal difference between countries southwest of us, such as Mexico and Central America, and our portion of Indiana, or regions northerly from us.

It would be interesting to repeat those experiments here, as I shall do if health permits, during the summer, these having all been made in January and February of this year. And, as we are here *west* of the agonic line, it would be interesting also to repeat them in some of our eastern cities which are situated *east* of said agonic line. If the currents then should be found to come from the southeast, occasioned probably by the great heat in northern South America, the variation or declination of the needle would then appear to cause said needle to assume a position parallel to the so-called currents. The magnetic needle does often undoubtedly assume that relation to a weak current transmitted along a single wire, although when the current is strong, as in the solenoid, the needle places itself at right angles to the current.

One more suggestive thought before I close: In statical electricity, the non-conducting glass of the Leyden jar enables that peculiar mode of motion to accumulate on the surface of the gold leaf within the jar when charged. A result somewhat similar amid the molecules of steel may, perhaps, explain the reason why *pure iron* easily receives and easily parts with that mode of motion, or form of energy termed magnetism, while *steel*, in which molecules of carbon, comparatively non-conductors, are interposed between the molecules of iron, retains its magnetism.

In the case of the Leyden jar, if we connect the pent up motive molecules of gold leaf with the outside foil by a conductor, we have a rapid transference of motion; but if no conductor is presented, the motion remains bottled up, so to speak; just as with other modes of motion (first vital, then chemical action and heat) derived remotely from the sun, there is energy hoarded up in the stick of firewood or lump of coal, to be converted, under certain circumstances, into the artificial heat necessary to maintain normal nervous energy (probably another form of motion) during periods of great climatic cold.

In the same way, perhaps, magnetism remains dammed up by the carbon, until, by the proximity or contact of a conductor, we render practicable the transference or propagation of the motion. Of course, besides the magnetism which we can induce by proximity of magnetized bodies, the earth's inductive action is always operative on all iron vessels, giving them, while they remain in certain fixed positions, the properties of a magnet; and if of steel they soon become *permanently* magnetic. By running a sewing needle through a short cork, and using the former as a pivot for a delicate magnetic needle, the above phenomena can be readily observed in all permanently placed stoves, hinges, locks, etc., or even in iron tinned cups piled on each other and subsequently detached, thus first forming a long magnet and then a number of smaller magnets. The magnetism, or polarity, is proved by applying your magnetic needle and finding the *lower* end of your stove, especially if it is of a round or cannon form, uniformly attract the *south* end of your needle, while the *upper* part of the stove, hinge, tin cup, etc., as invariably attracts the *north* or marked end of your needle. Should new facts present themselves, I may perhaps offer a statement of them in a future communication.

Very respectfully yours,

RICHARD OWEN,
Professor Natural Science.

Indiana State University, Bloomington, Ind., Feb. 8, 1878.

[We have since received a later communication from Professor Owen, dated February 11, 1878, in which he states that he has been able to repeat these experiments a number of times and in a variety of ways, during four additional days. The results were the same, except that the amount of deflection varied; being, however, usually from 18° to 26°. He also states—referring to the experiments of M. Bourbouze, of Paris, described in the SCIENTIFIC AMERICAN of February 16—that, although the results obtained by the French physicist, in his experiments with the galvanometer and water tank, were given to the public previous to his own, still he (Prof. O.) began his observations over a year ago. Professor Owen believes himself to be the first to indicate the direction of the current in the earth's crust.]

Patent No. 200,000.

Among the patents leaving the Patent Office on a recent date, is one issued to Shea and Hamilton for a carbureter, which bears the number 200,000. This, however, is not the whole number of patents that have been issued, but only those granted since the reorganization of the office in 1836, as before that period the patents were not numbered. The whole number of patents issued from 1790 to the reorganization in 1836 numbered 11,348. By adding these to the No. 200,000 above referred to, we get 211,348 as the whole number of patents issued up to the granting of the patent of Shea and Hamilton. The average number of patents issued yearly, up to and including 1836, was 247. The average since that time was 4,839.

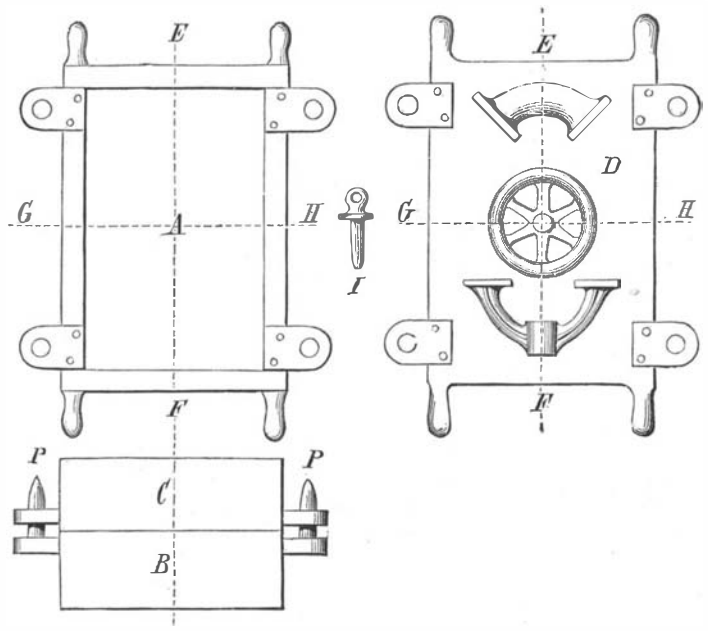
© 1878 SCIENTIFIC AMERICAN, INC

[For the Scientific American.]

ECONOMY IN PATTERN WORK.

It is often a source of considerable dissatisfaction that a person cannot obtain a cheap casting without a costly pattern. Many shifts are made to avoid this expense and the attendant delay; for instance, if a casting breaks, the pieces are sometimes temporarily united and made to serve as a pattern. Sometimes what is termed a skeleton pattern is given to the moulder—a mere outline of the thing desired; or, perhaps, even only a portion of it. I do not wish to enter into details or offer examples of these shifts and contrivances, and only mention the practice to show that a want is felt for cheap patterns, especially when only a few castings are required. Let me now, therefore, call the reader's attention to a contrivance which may satisfy that want to a certain limited extent.

Let the iron or brass founder use one or more flasks of the kind shown in the engraving at A, B, and C. A is a plan of the flask; B and C are end views, showing the two parts, nowel and cope, placed together. This flask does not differ from that ordinarily used except in one particular, namely, the centers of the pins, P, in the nowel, B, and the centers of the holes in the cope, C, must be equidistant from the center lines, E F and G H. Let a strong board be made similar to that shown at D in the engraving, battened on one side to keep it straight, the other side being planed true and free from curve or twist. Let four iron lugs, with holes in them similar to those usually screwed to the cope part of a common flask, be fixed in like manner to this board, and let the centers of the holes be at equal distances from the center lines, E F and G H, making those distances the same as those adopted for the flask. It is now evident that the board, D, may be so applied to the nowel, B, that the four pins in B shall fit into the four holes in D, and that it will be retained in position by them; in like manner the board may be applied to the cope, C, so that the four holes in the one shall exactly coincide with those of the other. When so applied it is only necessary to place two or more pins, such as shown at I in the engraving, in the holes, and the board will be retained in its position with reference to the cope.



PATTERN WORK.

Things being so arranged, we are prepared for business. Any article whose parts are symmetrically disposed about a center line (and there are hosts of such) may be made from half a pattern. Herein is the economy, for it is presumed that half a pattern costs less than a whole one. Let the half patterns of any such articles be placed upon the board, D, so that the center line drawn upon the pattern falls exactly upon that drawn upon the board. Our engraving shows three different kinds of half patterns so placed, a bend, a wheel, which has perhaps a rim round or oval in section, and a hanging bracket, sufficient to fill the flask, and all to be moulded at the same time. The half patterns having been placed as required, they must be retained in their respective positions by pegs passing through from the back of the board and fitting easily into holes made a short distance into the patterns. Place the nowel, B, upon the board with its pins in the holes, and clamp it there; ram it with sand and turn the whole over; lift off the board and draw the patterns. Replace the patterns on the board and apply the cope, C, to it, passing at least two pins through the holes to hold the board and cope in position; ram the cope and make provision for ventilation and the admission of metal, continuing the process as before directed for the nowell. The cope and nowel, when placed together, will now form a perfect mould.

The author has seen this arrangement carried out for a piece of work where hundreds of pieces were required. It gave perfect satisfaction. The half patterns, once placed upon the board correctly and pegged, are good for any number of pieces, and all the rest goes easily. It is immaterial whether close or snap flasks are used; the arrangement holds good for all machine framing which is symmetrical, such as brackets, bends, elbows, tees, straight pipes, wheels with an even number of straight arms or without any, etc. We may even go a step farther, for if the piece is in its main parts symmetrical but has upon one side a hub or branch of some sort not required upon the other, then if such hubs or branches are attached by easily fitting pegs they may be retained when ramming the nowel and removed when ramming the cope, or *vice versa*.

Unlike the makeshifts for economy's sake alluded to, the arrangement here recommended throws no extra labor upon the moulder. There is simply the expense of a few flasks—and let me ask the question, If four pins have to be attached why may they not be placed in a certain position? So that it only amounts to this, that every flask of the same size should have its pins or holes in the same place, so as to accommodate if necessary the same board. It is not, however, imperative to proceed to this extreme.

How to make Stearine Pictures.

This stearine relief process depends upon the property which bichromate of potash, mixed with gelatine, has of becoming insoluble by light. If a glass plate be covered with this mixture, and exposed in the ordinary way, in its after manipulation in water those parts not touched by the light will swell up, while those acted on by it, and consequently insoluble, remain flat; in fact, a relief is formed from which any number of impressions in stearine can be taken. These stearine impressions are afterwards rubbed with silver powder, stuck on blue paper, and the effect is something charming. They are produced in the following manner.

When the impression has been taken, the relief must be finished on a flat, stiff surface—a glass plate, for instance. Consequently, no transfer can take place, on which account the half tones are in no way injured in washing. The exposure must be from behind, which, naturally, can only be done if the gelatine layer is spread on the negative itself, and this is no very great difficulty. The collodion used should be a good portrait collodion, if possible containing a little water; it is also improved by the addition of a little castor oil. Moreover, the use of crown glass may be recommended, and, before collodionizing, flood with a solution of albumen, and let it dry.

After the negative has, in the ordinary way, been exposed, developed, fixed, and well washed, it is then either placed in rather hot water, or flooded with it for some minutes, the temperature about 25° to 30° R. This preliminary warming is on account of the future pouring on of the chrome gelatine solutions, and is very important.

1 { Nelson's patent gelatine..... 75 grammes
  { Distilled water..... 1 kilo.

and then—

2 { Bichromate of potash..... 10 grammes.
  { Distilled water.....100 "

The commercial gelatine usually made from calves' feet is absolutely useless for employing in this proceeding, it not giving sufficient relief.

The gelatine of better quality, which I have mentioned above, is produced by Nelson, and is prepared from algæ, or moss, and answers excellently for this process.

From mixture No. 2 add a small quantity in drops to the gelatine solution, keeping it continually stirring, estimating the mixing at about 3 drops to the 100 cb. m. (Of course, both solutions must undergo careful filterings.) From this warm mixture a small quantity should be poured on the now wet and warm negative, carefully avoiding air bubbles, and spreading it equally in all parts. This is only preliminary, and serves to produce an isolated layer between the original and the relief, and prevents, in after washings, the dark parts of the negative relief layer, which are under, from being washed out.

After having treated the negative in the manner described, this gelatine solution, mixed with the bichromate of potash, is run off at a corner, and the plate then placed for a short time in the light to dry, and any superfluity of the mixture removed with gentle washing. Now the second—the real relief producing liquid—can be employed.

Beforehand it is well to surround the plate glass (which it is advisable to have somewhat thick) with a margin of cardboard, which can be either stuck on or tied firmly round it, so as to form an edge about five millimeters high. This edge serves to prevent an overflow of the gelatine solution. Into the dish thus formed is poured the gelatine solution, which, by the addition of the bichromate of potash, has been rendered sensitive to the light, and the negative covered to a height of some three or five m. m. One must anxiously avoid air bubbles. Afterwards thoroughly dry in a horizontal position in a warm room. Then it can be exposed, taking it carefully, in such a way that the negative (the gelatine side downwards) is placed on a board covered with black cloth, and for some hours exposed to the diversified rays of the daylight. By proper exposure, the gelatine layer assumes a yellow brown appearance.

The development of the picture is comparatively easy. Pour into a dish some thoroughly hot water, into which the plate should be once dipped. The temperature of the water employed varies according to the quality of the gelatine used. As a working rule, it may be observed that the higher the temperature of the water the greater the relief obtained, as it rises energetically. Bubbles are not to be feared if a good gelatine be employed.

As observed, nearly every quality of gelatine has its own temperature at which it swells most readily. To find this out is a matter for investigation—still, soon arrived at; in any case, it is preferable to use a gelatine that always gives the same results. With Nelson's gelatine the temperature at about 50° R. is the best.

On the application of the warm water the relief comes up quickly, those parts unaffected by the light swelling rapidly up, while those acted on should remain flat and solid. We can now perceive over the thick places of the negative a partial solution of the gelatine spreading itself under the isolated layer—in other words, a bas relief forming on the sensitized gelatine plate, in which the lights, and especially the light parts, lie deeper than the shadows.

On the contrary, if a diapositive be covered in the manner described, with the sensitized gelatine mixture, and afterwards exposed, the light parts would let much light through, by which the gelatine layer would be affected to a considerable depth. By the manipulating in hot water afterwards the insoluble parts remain, and we obtain high relief.

In most cases the production of the bas relief is to be preferred, which can be regulated according to the flooding.

The gelatine should be then prepared with a layer of a well concentrated solution of white shellac dissolved in alcohol; the stearine melted over a gentle fire, and then poured, carefully avoiding air bubbles, over the gelatine. On its drying, turn up the plate, and a few taps on the back will remove the impression.

In conclusion, rub the impression over with silver bronze, and mount on a piece of blue paper or card. A great improvement on this process is to be arrived at by carefully mixing marble or alabaster powder (such as can be obtained from sculptors' studios) with the stearine. Melt the stearine over a gentle fire, and add in small quantities the powder, carefully stirring and watching the mixing. In pouring into the mould, the powder sinks, so that the top layer of the stearine impression presents the appearance of finely sculptured marble.

In conclusion, it is well to remark that in producing reliefs of persons with light or golden hair, it is well to powder the same; otherwise, as in photography, the gold comes out black, and the hair in the stearine impression appears too sunken.—*Photographisches Wochen-Blatt.*

The Conditions of Invention.

The recent discovery of the liquefaction of the so-called permanent gases is only a practical application of principles long known. Berthelot and Andrews long ago indicated the conditions under which this probably could be accomplished, and Dumas even calculated the density and other characteristics of liquid oxygen. Moreover, that these gases were susceptible of liquefaction has always been a corollary of the modern thermo-dynamic theory; and to assert to the contrary has always been admitted as the expression of a paradox.

Substantially the same is true of the flying machine. The conditions of mechanical flight are all well settled. The first requirement is the condensation of the maximum of power into the minimum of space, and the anatomy of the bird virtually tells the rest. That the correlation of gravity with the other natural forces will be discovered is probably only a question of time. Faraday announced his belief of the possibility, and cleared the way for the application of the principles which ultimately may lead to its detection. There are abundant opportunities for invention and discovery which involve simply the application of the elementary principles of physical science, which should form a part of every one's education.

The Nordenskold Expedition.

To aid the expedition of Professor Nordenskold in the Arctic regions, having for its object the demonstration of the practicability of navigation in the Polar Sea north of Asia, the Navy Department has collated much material in the shape of charts, etc., produced from the surveys of the United States North Pacific and Arctic exploring expeditions (1853–56) and reports of Rear Admiral John Rodgers, the commander of that expedition, who in the month of August, 1855, proceeded through Behring's Straits (which Professor Nordenskold expects to penetrate) into the Arctic Ocean as far north as latitude 72° 2′ north, longitude 174° 37′ west, and then westward as far as latitude 70° 45′ north, longitude 176° 47′ east of Greenwich, which will no doubt make his reports and charts very welcome to the Professor, as they contain many details of the atmospheric conditions during that month, as well as of the depth of the water, magnetic variations, force and direction of the currents, etc., which cannot readily be obtained from any other source.

The Phylloxera and American Vines.

It has been discovered that several kinds of American vines withstand the ravages of the phylloxera, notably the "Clinton." A vineyard at Montpellier, France, is now largely planted with stocks of the Clinton grape, on which the French Aramon vine is grafted. The grafting is necessary to obtain grapes whose wine has a satisfactory taste. A work recently published at Bordeaux describes the American vines best suited for stocks, and specifies the French vines that can be grafted on them to advantage. For awhile it was hoped that German stocks would have answered the purpose, but they are found unable to resist the insect pest.

© 1878 SCIENTIFIC AMERICAN, INC

LAW'S DOUBLE SHEARS AND ENGINE.

The form of lever shears shown in the accompanying illustration is described in *Iron* as a compact and convenient tool for steel melters and for iron works in general. It is intended, as may be seen from the shortness of jaw, for cutting rods, bars, and rails, or for ordinary smiths' purposes, rather than for plate work.

The driving engine is vertical, of the steam hammer class, with T-shaped framings, carrying the guide and swelling out at the bottom to allow the play of the crank. The speed is regulated by the usual Watt's governor and throttle valve. The engine drives a strong main crank shaft, carried by two plummer blocks upon the main framing. This shaft is fitted with a large and heavy fly wheel. A strong pinion flanged up to the pitch line is keyed upon this shaft, and gears into two strong spur wheels in a ratio of about one to three, or more if required, which are also flanged up to the pitch line. These spur wheels are each carried on countershafts by two bearings, each cast upon the main framing with the usual gun metal steps. Upon the outside extremity of these shafts, overhanging the bearings, are two cast steel disk plates, with crank pin of small throw.

The crank pins work in two gun metal sliding blocks, cast hollow, to give the maximum bearing surface with a moderate amount of material. The crank pins thus revolve in the sliding blocks, whilst the latter slide horizontally in a planed slot in the shearing levers. A reciprocating up and down motion is thus produced in the shearing levers. The resistance of shearing is all met in the up stroke of the crank pin, and therefore the pins are arranged opposite to one another in their throw, so that they work alternately and balance the total effect upon the engine. The weight of the lever arms themselves will bring them back to open the shear jaw, so that the working pressure is always on the upper face of the block, and will prevent any liability to knock in the slot, and, therefore, no adjustment of the blocks is required or provided. The gun metal sliding blocks have flanges on the inside faces, so that when once inserted in place they cannot get out of place again.

Both faces of the slot in the punching levers are planed, and upon the outside faces is a planed face arranged radially from the center pin. Bearing upon this radial face is an adjustment plate, so arranged that it can be pressed by a set screw upon the small end of the lever to bring the shears home to their work, and to prevent any jumping away from their work when cutting. The levers themselves are cast iron, faced with steel shear plates at the cutting end, and rocking on iron bearing pins, to which suitable lubricators are provided in the castings. The two levers are arranged for different sizes of jaws, and therefore for different powers. The shears are respectively 12 inches and 15 inches, and the gearing is about 1 to 3 and 1 to 4 respectively, so as to give suitable lengths of leverage to the different resistances. The whole of the different bearings is cast in one solid box bed plate, which serves also as foundation plate for the vertical engine, a suitable gap being provided for the fly wheel.

Prairie Chickens introduced into California by the Railway.

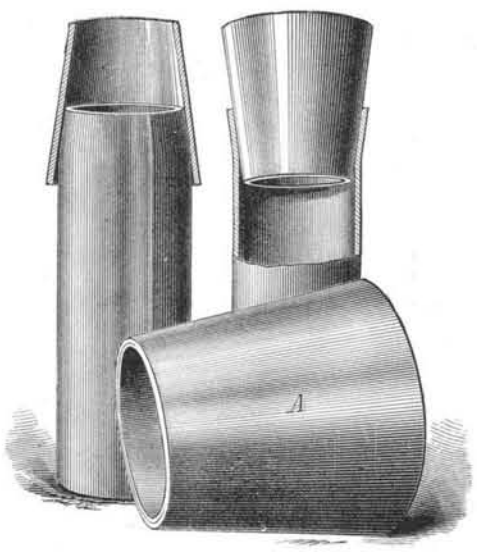
The absence of this choice bird among the feathered game of California is well known, and various efforts had been made by individual enterprise to introduce and acclimate it, but without success; and the possibility of this desirable result has long remained in doubt. But it seems that the bird is solving the problem for us. Starting from the prairies of Nebraska, it has followed the railroad westward, its appearance being noted from time to time in localities along the line, where it had never before been seen.

It has already extended its wanderings into Surprise valley in Northeastern California, and its diffusion over the whole state is now believed to be only a question of time, and reasonable forbearance on the part of gunners.

AN expedition, having for its object the thorough examination of the natural resources of Russian Turkestan, is about to leave St. Petersburg. M. de Middendorf, the famous explorer of Siberia, and M. Smirof, Conservator of the Botanical Museum of the University of Kazan, will be among its members.

IMHOF'S STOVE PIPE EXPANDER.

It is scarcely necessary to recall to any one who has ever put up a stove how annoying a task it is to fit together sections of pipe. No matter how nicely these were joined when taken down, it is almost a certainty that they will not go together after a summer's sojourn in the barn or cellar, and to attempt to force them usually ends in bruised fingers and split pipe, and ultimately in sending for the tinman. Mr. Henry Imhof, of Lockport, N. Y., has devised an exceedingly simple means of avoiding all this trouble, the utility of which is so obvious as probably to render it hereafter indispensable in all households where stoves exist. It is merely a hollow truncated cone (A in our engraving), of any suitable dimensions, made of sheet metal or other material. Its use is plain from the illustration. The smaller end of the cone is inserted in the end of the stove pipe and forced into



STOVE PIPE EXPANDER.

the same. The pipe is thus expanded as required. To contract the pipe the end is inserted in the larger opening of the cone, which is forced down as before.

Patented January 1, 1878. For further information address the inventor, box 982, Lockport, N. Y. State and county rights for sale.

Iridescent Glass.

Among the thousands of objects, both curious and artistic, which fill the halls of the Metropolitan Museum of Art in Fourteenth street, there are none to which the eye of the visitor will be attracted with more interest and admiration than the specimens of glass ware which were exhumed by General di Cesnola from the tombs of Idalium, in the Island of Cyprus. This collection of Greek glass, the most extensive known, comprises 1,700 articles of all kinds, shapes, and sizes, plain and colored, incrusted and iridescent. But the specimens to which the attention of the beholder will be more especially drawn are those which have an opalescent, pearly, or nacreous surface, lustrous as a rainbow, and beyond all description beautiful. Although at the time of their discovery there was some discussion as to whether the exquisite effects which these objects exhibit were not the result of design on the part of the skillful old craftsmen who constructed them, it is now pretty well known that they are due to a sort of decomposition which the glass has undergone during the long lapse of time since they were first placed in the depositories where they have been found. Close examination has not thrown any light on the cause of iridescence in glass, but the theory is that when this substance is exposed to influences which gradually decompose it, its surface becomes covered with delicate laminæ, like those of mother-of-pearl, and that the rainbow colors are due to the phenomenon known in optics as interference of light. Similarly the luster of opal is due to refraction caused by the number of parallel plates of which it is composed. The iridescence of Labrador spar may be given as another example, although in this case the plates of which it is composed are much more solidly compacted.

This peculiar alteration in glass has been observed to take place when it has long remained under water or in moist ground, or when it has been exposed to ammoniacal vapors (as in the windows of stables), or to the acid vapors thrown off by volcanic ashes, and especially in glass objects found in ancient burial places.

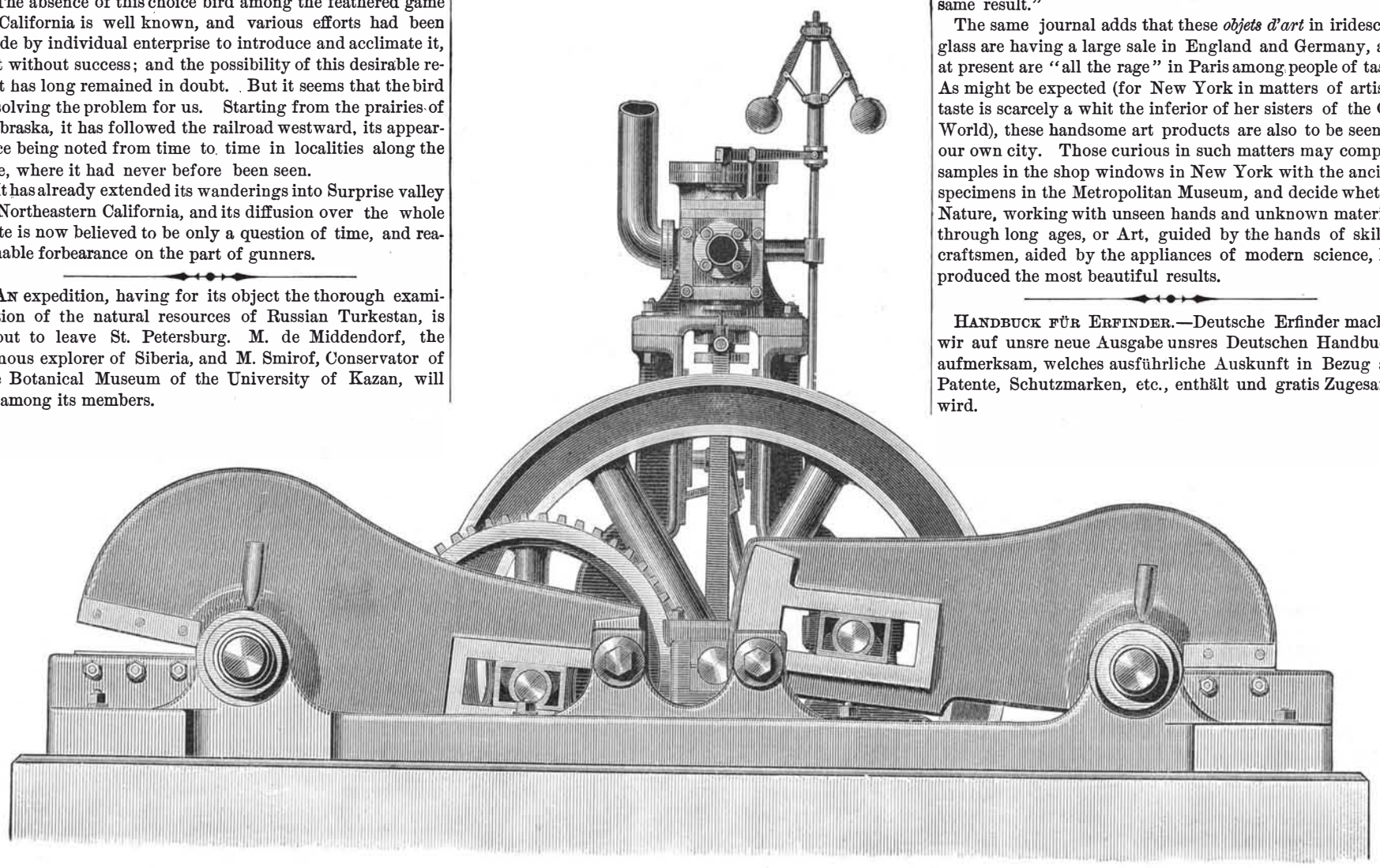
Not very long since two French chemists, MM. Fremy and Clemandot, after numerous experiments to discover a method by which glass might be permanently "iridized," so as to give it the aspect of pearl or of nacre, were rewarded by success. Their process consists in submitting the glass, under the influence of heat and pressure, to the action of water containing fifteen per cent of hydrochloric acid. On the authority of *Industrial Art*, a continental firm of glass manufacturers succeeded, a few years ago, in mastering the secret by which glass during its process of manufacture at times became as many colored as a soap bubble. Their first consignment to England, exhibited under the name of "Russian glass," did not attract as much attention as it deserved; but convinced that the work had in it intrinsic merits deserving of recognition on the part of the public from an art point of view, the exhibitors continued their investigations into the mode of its production; and selecting the most appropriate designs for its display, in the form of the best models of classic art, have produced a multitude of articles which are said to be exquisitely beautiful, and in price so moderate that they will readily come within the reach even of the possessor of a slender purse.

The current number of *Le Propagateur*, in commenting on this new iridescent glass, makes the following remarks in regard to its manufacture:

"In Germany the glass to be iridized is heated and a metallic oxide deposited on its surface by reduction. The oxide forms striæ on the surface, and these determine the phenomenon of iridescence. Bismuth seems to be much used in the principal glass works as the iridizing metal. In fact, M. Peligot, the eminent chemist, who has analyzed these iridescent glasses, found appreciable quantities of bismuth in them. Any metal whatever might, perhaps, produce the same result."

The same journal adds that these *objets d'art* in iridescent glass are having a large sale in England and Germany, and at present are "all the rage" in Paris among people of taste. As might be expected (for New York in matters of artistic taste is scarcely a whit the inferior of her sisters of the Old World), these handsome art products are also to be seen in our own city. Those curious in such matters may compare samples in the shop windows in New York with the ancient specimens in the Metropolitan Museum, and decide whether Nature, working with unseen hands and unknown materials through long ages, or Art, guided by the hands of skilled craftsmen, aided by the appliances of modern science, has produced the most beautiful results.

HANDBUCK FÜR ERFINDER.—Deutsche Erfinder machen wir auf unsre neue Ausgabe unsres Deutschen Handbuchs aufmerksam, welches ausführliche Auskunft in Bezug auf Patente, Schutzmarken, etc., enthält und gratis Zugesandt wird.



LAW'S DOUBLE SHEARS AND ENGINE.

© 1878 SCIENTIFIC AMERICAN, INC

TEETH, CLAWS, TONGUE, AND WHISKERS.

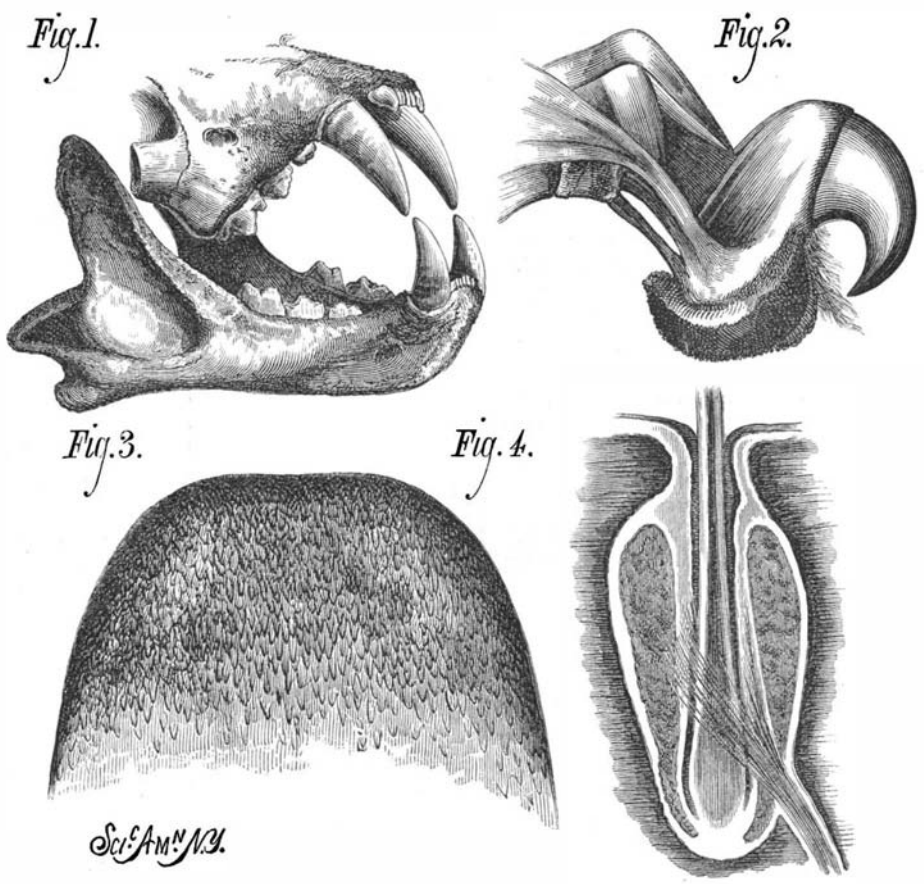
We have grouped together in the accompanying engravings (from Wood's "Natural History") some of the characteristic features of the lion, the object being to show the wonderful mechanism with which Nature has so richly endowed that animal to enable it to carry out the instincts which are implanted in its nature. The lion belongs to the *Felidæ*, or cat tribe, and the characteristics here noted are as true for the demure tabby which placidly purrs on the hearth, as for the fierce king of the African forest; while they are brought into play as actively and as completely in the capture and devouring of a mouse by the one as in the taking of an antelope by the other.

It is not generally realized that the whiskers of the cat tribe are the means of almost another sense. Each whisker hair is, in fact, an organ having an exquisite sense of touch, and is in connection with a set of large nerves which convey to the brain a perception of the slightest impact. In Fig. 4 is given a magnified representation of a single hair bulb of one of the whiskers, together with the nerves by means of which the hair is converted into a tactile organ. If the extremity of the hair is touched a pressure is instantly made on the nerves at its root. By means of these delicate feelers, the animals are able to guide themselves through the thickets, and to escape the risk of alarming their prey by too rude a contact with the branches.

When a lion kills an eland, and does not happen to be very ravenously hungry, he feeds daintily on the heart and other viscera, rarely touching the remainder of the flesh. In so doing he rips open the abdomen with his powerful claws, thus bringing to play a second time the talons which are so curiously adapted for seizing and holding the victim. The mechanism of the cat's claw is shown in Fig. 2. When the animal is at rest, the upper tendons draw the claw backward, so that it is lifted entirely from the ground, and the weight of the body rests only on the soft pads which stud the under surface of the foot. But when the creature becomes excited, and thrusts out its paw for the purpose of striking a blow or clutching at its prey, the upper tendons become relaxed, while the lower tendons are tightened, and the claw is thrown forward, ready for use.

Another curious structure common to all feline animals is found in the tongue. The finger passed over the tongue of a cat will show at once that it is dry and rough, and thus in strong contrast with the wet, smooth tongue of the dog. Examination of the surface with a magnifying glass will show, however, that the entire surface of the tongue is covered with innumerable conical projections, which are so curved that their points lie towards the throat. On the central line of the tongue these projections are longer than at the side. Their chief if not their only use is to aid the cat in stripping the flesh from the bones of the animal which it has killed, and so to prevent the least waste of nutriment, a curious example of Nature's economy. So strongly made are these projections that the constant licking of a cat's tongue will remove the lining tissues from a delicate skin, while the tongue of the lion, Fig. 3, can rapidly cause the outflow of blood.

The teeth of the exclusively carnivorous animals are always of a form which permits them to seize and tear their prey, but does not give them the power of masticating their food after the manner of the vegetable feeders. None of the teeth are furnished with the flat surfaces which are necessary for grinding the substances which may be placed between them; and this inability does not lie only in the teeth, but extends to the very framework of the jaws. As may be seen on reference to Fig. 1, the lower jaw is so largely developed at its base, and fits so deeply into its socket, that lateral motion is impossible. In order to give a more perfect view of the lower jawbone, the bone immediately above it has been removed and presents only its cut surface. This part of the structure is scientifically known as "malar," or cheek bone, and forms an arch, which has been termed the "zygomatic" arch. In the carnivorous, and more especially in the feline animals, this bone is extremely large in proportion, and is increased in strength by the very decided curve. The great size as well as the peculiar form of this bone are required for the purpose of affording protection to the enormously powerful muscles, by means of which these animals are enabled to tear their food, and also for the attachment of certain jaw moving muscles. There is an upward as well as an outward curve in the malar bone, which gives strength precisely where it is most required.



THE LION'S DESTRUCTIVE APPARATUS.

A NILE BRIDGE.

The innovations which modern progress is making in Egypt could hardly be better illustrated than by the accompanying engraving of a projected bridge which is to cross the Nile at Mansurah. It is to be constructed from the designs of Signor Alfredo Cottran, a well known engineer of Naples and managing director of a large engineering establishment at Castellamare, which has erected more than one thousand metallic bridges in Italy, Spain, and Turkey. It is to be built partly of stone and partly of iron, and the construction will be a combination of the suspension principle with straight girders, a method frequently adopted in this country for large spaces. The two main piers are constructed of wrought iron, cast iron, and masonry, and the superstructure will be composed of two stages superimposed, the lower being intended for a railway and the upper for an ordinary roadway, with pathways for foot passengers on either side. The engraving (which we copy from the London *Graphic*) shows a curious blending of the architecture of the Ptolemies with the more practical, if less ornamental, system of construction adopted by nineteenth century engineers.

Foreign Industrial Notes.

Tanned Fish Skins.—At the maritime exposition held at the Westminster Aquarium there were exhibited the tanned skins of various fishes, susceptible of a multitude of uses. There were, especially, skins of eels prepared for harness, skins of flat fish for glove making, shark skins more than nine feet long by three wide, yielding a superb leather. The same exhibitor sent from Christiania bands of whale skin fifty-eight feet long, designed for making driving belts for machinery.

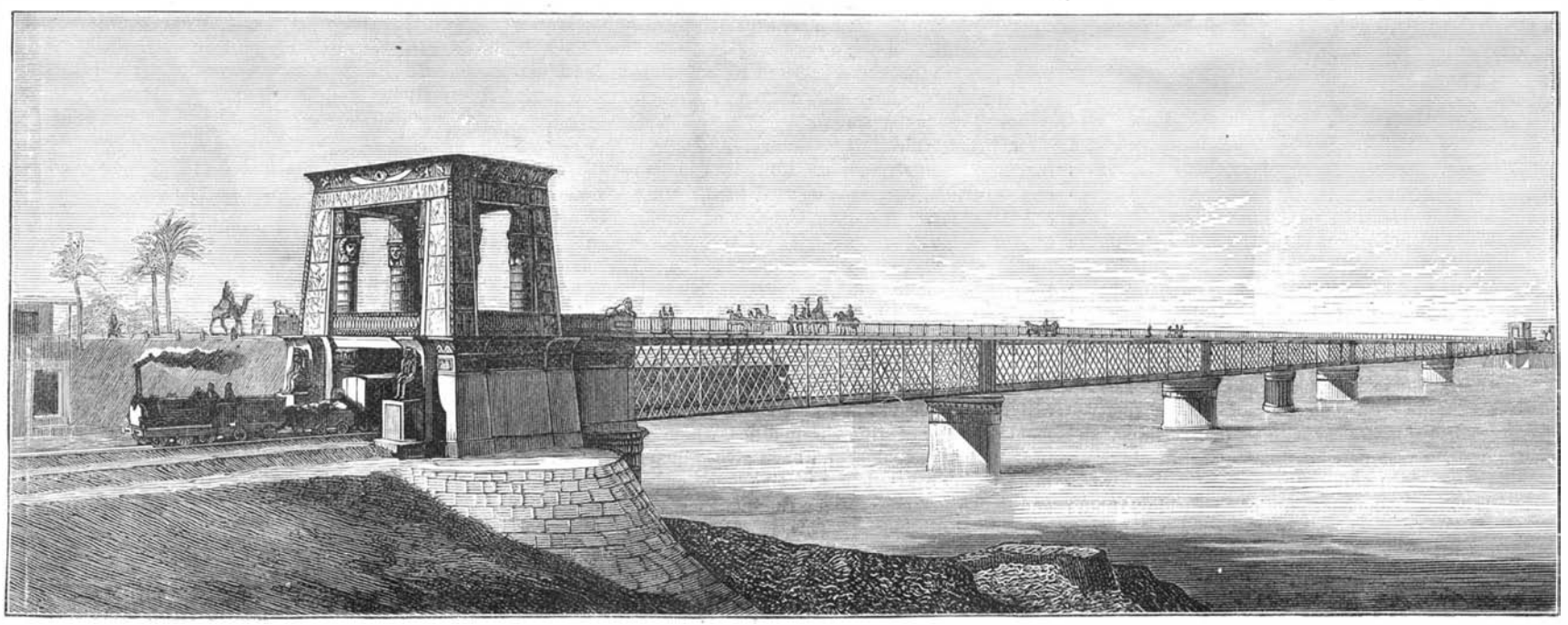
A New Barometer.—In the *Bulletin Français*, M. De Parville describes the mode of construction of a new form of barometer, which is not claimed as an instrument of precision, but to be cheap, simple, and tolerably accurate.

A medium sized bottle is tightly stopped with a cork traversed by a quill tube. This tube should be about one tenth of an inch in diameter and 19 or 20 inches long, and should extend into the bottle for two thirds of its length. The joints must be made thoroughly air-tight with wax. Then slightly warm the bottle to dilate the air, and dip the extremity of the tube under water while cooling. In this manner fill the bottle so that the surface of the water just touches the inner end of the tube, then add a little more until it stands in the tube at some easily remembered level. This is the whole apparatus. When the weather threatens rain the surface of the column of water will sink, and *vice versa*. Variations in temperature also cause changes in the length of the column, but a little practice will enable the observer to allow for these, or if the instrument be kept in a cellar or in any other place of even temperature they will not occur.

New Process of Tanning.—An Italian chemist, M. Paesi, of Mortara, has discovered a new process of tanning, much more rapid than the old. It consists in letting the skins macerate in a bath of perchloride of iron and marine salt, in solution in water. The total operation lasts only from four to six months, of which only the half is for tanning proper. Moreover, the perchloride of iron being a powerful disinfectant, the new method insures the wholesomeness of an industry which has hitherto been very nauseous. The French *Journal d'Hygiène* has called particular attention to this process, and the *Conseil d'Hygiène* of the Puy de Dôme has undertaken new experiments on the subject, with a view of remedying in certain quarters of Clermont and Ferrand the infection arising from the cause referred to.

Improved Process of Engraving on Glass.—The action of hydrofluoric acid on glass being very rapid, and its use being attended with great danger, the *Jeweler* recommends the following as a safer method of engraving:

A coat of engraving varnish is put on the glass with a pencil. The varnish, which goes by the name of "Florence," is one of the best. It is heated in a varnish pot, and linseed oil and mastic in drops are added in equal portions. Mix and pass through a cloth. Keep in closely stoppered bottles. The varnish is spread so as to leave the parts to be engraved uncovered, that the drawings may be traced with a metallic point. A paste of fluate of lime in powder and concentrated sulphuric acid is put on in a thin layer. This paste acts



PROPOSED IRON RAILWAY BRIDGE ACROSS THE NILE.

© 1878 SCIENTIFIC AMERICAN, INC

slowly on the glass wherever it is not protected by the varnish. It is left to stand for two or three hours. The glass is then cleaned first with water and afterward with alcohol.

Burning Cheap Fuel.—The Jarvis Furnace.

The remarkable economy that has been realized by burning screenings, with little soft coal under boilers set with the Jarvis patent gas consuming furnace, without a blower, has excited a great amount of discussion among engineers, and considerable interest among manufacturers and steam users, who are reaping the benefit of using it by a reduction in the amount of their coal bills. Letters patent were granted for this improvement April 25, 1876; January 30, 1877, and April 24, 1877. The furnace is adapted to setting any kind of a steam boiler. The alterations and additions to be made when the ordinary setting is to be changed for the Jarvis setting can be made in a few days. Hence several extensive manufacturers have availed themselves of the improvements, and express in no measured terms their high satisfaction at the results obtained in economy of fuel and the production of steam.

The principal features in this furnace consist in the setting whereby air is admitted by small flues in the front and then conducted through a number of horizontal expanding ducts, in which it traverses backward and forward until it finally, and in a heated state, enters by the furnace bridge wall and other places, uniting with the products of combustion and causing consumption of the gases. The peculiar manner of setting allows the burning of screenings with a small portion of soft coal, without the use of a blower, by joining the hot air (oxygen) and gases. What is especially claimed is that cheap fuel, such as screenings, green wet peat, slack coal, sawdust, green wood, logwood chips, etc., can be used without auxiliary blast, that the gases are burned, that great economy is effected, and that three boilers with this description of setting will do the work of five boilers set in the old way. These claims are fully established. The company further claim an increase in evaporation of water over all old ways of setting of from 15 to 25 per cent, in using the best class of fuel.

The improvements, we have already said, consist in a peculiar way of setting the boiler in brickwork. Our own observations respecting boilers and boiler setting allow us to state that although for the past twenty-five years there have been very marked and notable improvements in the construction of boilers, too often has the setting of them been left to the judgment of a mason, who would do it in the cheapest manner and according to his own ideas. The results obtained by the Jarvis furnace prove how important the proper setting of boilers is in the economy of fuel, and maintaining the durability of the boiler. The old way of setting a boiler has generally been to set the boiler from 18 to 20 inches above the grate, and to have all the air for feeding the fire pass into the ash pit, up through the grate.

In the Jarvis furnace this order of things is reversed. The boiler is placed from 24 to 30 inches above the grate, on the principle that what the fire needs in addition to air through the grate is pure hot oxygen on top of the fires to mix with the gases generated on the grate. Air is admitted through passages in the side walls of the furnace, that discharge over the bridge wall; this is heated very hot in its passage, and when it comes out it immediately mixes with the gases and bursts into a blue flame. Air is also admitted from the back of the furnace through expanded passages laid at the bottom of the flame bed. This is also heated in its transit, and strikes underneath the body of gas and flame back of the bridge wall. The fire is a surface one, and the hot pure air, which doubles at 568° of heat, having sufficient room to expand, makes an immense flame. It makes its own draught, and of such force that coal dust and screenings are burned freely, without blowers or blast, and in some cases with the dampers only one quarter open; in other words, the heat is held, and it is perfect *slow combustion.*

We recently examined the Jarvis furnace at the works of Messrs. P. Lorillard & Co., Jersey city, N. J., and found it in very successful operation. Two boilers, built by Samuel Secor & Co., are set in the manner described. One only was in operation, and this was furnishing steam to the buildings, and a horizontal steam engine having a cylinder 24⅜ inches in diameter and 48 inches stroke. This engine had a driving belt wheel, 16 feet 6 inches in diameter with 33 inches face, and was making 40 revolutions per minute. The description of the one we saw in operation will serve for both boilers. This is a plain horizontal tubular boiler, 150 horse power; diameter 7 feet, length of shell 18 feet, number of tubes 112, diameter of tubes 4 inches, thickness of boiler plates $\frac{7}{16}$ inch, thickness of heads $\frac{5}{8}$ inch. The fuel being used was anthracite screenings, worth 80 cents per ton; soft coal, worth $4.25 per ton, and pea coal worth $2 per ton. The mixture being used was two parts of screenings to one of pea and one of soft coal. The grate has the Adams' grate bar with ⅜ inch opening, and was 6 feet wide by 6 feet 6 inches long. The heating surface of the boiler is 2,250 square feet, and the average working pressure is 65 lbs. The consumption of fuel in 24 hours is 10,000 lbs., and will be less rather than more in future as requirements will be ascertained and the consumption of fuel brought down to a minimum. The use of pea coal is optional with the company, and not a necessity. The damper was half closed, and yet the fuel burned with as much intensity as if there was a moderate blast from a blower. The blue flames at the sides and back of the furnace showed that consumption of the gases was taking place. The same description of furnaces is in operation at the Allen Print Works, Providence, R. I., the Washington Mills, Lawrence, Mass., the Harmony Mills, Cohoes, N. Y., at the brewery of Messrs. Gluick & Scharamann in Brooklyn, L. I., and many other places. The setting is adapted to all kinds of furnaces set in brick work, including retorts, heating, and puddling furnaces. It is also applicable to the western river steamboats, where slack coal and green wood can be used, allowing more steam to be made with a less number of boilers, and consequently effecting not only an economy in fuel, but giving more space for freight. Further information may be had from A. F. Upton, general agent for the Jarvis Patent Gas Consuming Furnace, No. 239 Congress St., Boston, Mass., or from R. H. Burns, No. 414 East 26th St., New York.

A MECHANICAL LARYNX.

A remarkable example of how mechanical ingenuity is called in to supplement surgical skill is furnished by the successful extirpation of a larynx by Dr. Foulis, of Glasgow, and the substitution therefor of a metal contrivance, which supplies the place of the lost organ so perfectly that the patient is able to talk with as little difficulty as if the operation had not been performed. For the benefit of the reader not familiar with the functions of the larynx, we may recall the fact that the voice is produced therein by the vibration of the column of air passing through a narrow slit which forms the entrance to the trachea and lungs. The natural mechanism of the larynx is closely analogous to that of a reed instrument, in which a column of air, passing forcibly through a narrow slit bounded on one or both sides by a

A MECHANICAL LARYNX.

thin elastic plate of wood or metal, first causes the edge of the plate to vibrate with sufficient rapidity, and is thus itself thrown into sonorous vibration. In the larynx every variation between the two extremes of high and low notes is produced in similar manner by alterations in the width of the slit and the length and tension of its vibrating edges or vocal cords. When, therefore, a person is deprived of his larynx he becomes like an organ without pipes. The lungs, which correspond to the bellows, are there, and so is the articulating apparatus, which answers to the keys, but there is no means of producing sound.

Dr. Foulis' voice tube, which is represented in our engraving, is exceedingly simple. It consists of two silver pipes, one of which, A, passes upward to the epiglottis, and the other, B, enters the open trachea, as shown. The lower tube slips into the upper one, and holds the reed plate and button, C. The current of air from the lungs impinges upon the free end of the vibrating reed, as shown by the arrows. The reed itself has been made of soft vulcanite; but the patient, who has considerable mechanical genius, and has become interested in the possibilities of his new larynx, has been making experiments on a large variety of substances, and has succeeded in providing himself with a perfect assortment of voices of different qualities, which he uses at pleasure. An alloy of silver and brass gives him a fine, rich tone; by changing his reed he can sing tenor or barytone at will, and render his tones soft or ringing, as he uses non-metallic or metallic substances. This, Dr. Foulis points out, proves the opinion already expressed, that the timbre of the human voice depends as much on the density, elasticity, and other qualities of the vocal cords as on the accentuation of particular sound waves in the buccal cavity.

The articulation of the patient is said to be wonderful, and, saving its monotony, it cannot be distinguished from the natural voice. The vowels are clear and distinct, both in whispering with the reed out and intoning with the reed in the tube, showing that the vowels are the product of changes in the shape of the buccal cavity and are not formed by alterations of the glottis. The patient progresses favorably, although somewhat subject to colds.

[For the Scientific American.]

Home Dentistry.

It is so clearly the best policy for all who suffer from dental complications to seek the aid of a skilled dentist, that it may be almost superfluous to premise that the following hints are written for those only who from want of funds or other causes are unable to obtain professional advice.

Decayed teeth should at once be thoroughly stopped, whether troublesome or not, because if the nerve is exposed a tooth will always be tender, unfit for use and liable to ache; while the food will lodge in the cavity and decompose, causing the breath to be offensive. To treat a decayed tooth, proceed as follows: First clean out the cavity, picking out all the decomposed parts which can be reached, and dry the interior with cotton. For this and subsequent operations a thin steel or iron instrument, sharpened at the point and slightly curved, will be found useful. Should the nerve be exposed, it should be killed. There are several ways of doing this. One method is to allow a drop of creosote to fall on a piece of cotton, when the latter is placed on the nerve in the cavity, filling in with pure cotton. Oil of cloves may also be used; it is slower in its action, but is more agreeable. Both of these are poisons, if taken into the stomach in any considerable quantity. They are therefore to be used on the teeth with care, and only at the place needed. For the plug take a bit of common gutta percha and plunge it into boiling water, which will soften it and render it as easy to manipulate as putty. The cavity having been cleaned and wiped dry, allow a single drop of the oil of cloves to fall upon a very small bit of cotton and force the latter into the hollow of the tooth, pressing it well in. Pinch off a piece of the softened gutta percha of the size of the cavity, dry it quickly on a cotton cloth, press it in with the instrument, and smooth the outside with the finger. If the cavity is in the crown of the tooth, close the jaws; the gutta percha will thus be moulded into the shape of the opposite tooth. In about ten minutes the gutta percha will harden and the tooth will be capable of use. If the nerve is not exposed and tender, the oil of cloves and cotton may be omitted. In case the tooth has decayed so far that a mere shell is left, apply sufficient gutta percha to form a complete cover. When two or three teeth touching each other are badly decayed, they may be covered with a single piece of gutta percha. If at any time the tooth becomes troublesome again the filling may be removed by the pointed instrument and a fresh one inserted.

It should be borne in mind that a toothache caused by an exposed nerve in a decayed tooth can be instantly cured by the application of the oil of cloves, which should be used with care, as above stated, so that it will not affect the sound teeth. When the nerve is destroyed future relief from pain is insured. Thus all who have broken or ragged teeth, and cannot obtain dentist's aid, may readily free themselves from pain and render the injured teeth serviceable.

A good wash for the mouth may be prepared as follows: Dissolve a little permanganate of potash in water, rinsing the mouth with a portion of the solution. This will destroy the organic matter hanging about the teeth and render the breath inodorous.

The Microscopical Postal Club.

The *American Naturalist* observes that this society has during the past year continued its operations with marked success and interest on the part of the members. Comparatively few slides have been broken, especially in those circuits where the new style of boxes has been used. The difficulty of mailing the slides has been as yet but a small and exceptional evil. The law against mailing glass is plain enough—the slides are unquestionably glass. Where the slides have been properly packed and posted without question or comment, there were few postmasters known to be so stupidly officious as to take any notice of an act so perfectly harmless in itself and so entirely within the spirit of the law. Those who desire to obtain information respecting this society, should address the Rev. N. B. Hervey, of Troy, N. Y.

The Cornetto.

Mr. J. F. Phillips, of 27 Chatham street, this city, calls attention in our advertising columns to the cornetto, a new musical instrument on which anybody can perform. It is only necessary to sing, or rather hum, into it, and the quality of the voice is entirely changed, so as to imitate the resonance of a wind instrument. The cornetto is neatly made of coiled reed, and can be carried in the pocket. The manufacturer states that a number of good singers by its aid can easily produce the effect of a "full brass band."

English Turbot and Soles for America.

A consignment of living English soles and turbot was recently sent from England under the charge of Mr. G. W. Mather, to Professor Baird, of the United States Commission of Fishery. These will be turned adrift in the Bay of Massachusetts. We wish Professor Baird every success in his endeavor to introduce in this country two of the finest fish that grace the table of the English epicure.

© 1878 SCIENTIFIC AMERICAN, INC

New Agricultural Inventions.

Mr. John W. Mahoney, of Bishop Creek, Cal., has invented an improved Plow, so constructed that the parts less subject to wear may be made of cast iron, while those most exposed are made of steel. The standard and mouldboard are of cast iron, in one piece, and have a rear flange to which is bolted a cast iron landside bar. The share and point are of cast steel, also in one piece.

A Harrow has recently been patented in which the tooth bars of each section are arranged transversely and connected by longitudinal bars which also act as runners. The teeth are drawn to an acute angle on one edge and to an obtuse angle on the other, the former edge being rearwardly sloped and the latter perpendicular, for the purpose of cutting sods, weeds, etc., and clearing themselves of rubbish. Teeth of this shape, the inventor, Mr. M. M. Dobbin, of Sugar Grove, Ill., claims, will pass through the ground more easily and enter to a greater depth than ordinary square teeth.

Mr. George Sprague, of Rockford, Iowa, has invented an improved Rotary Churn, in which the dashers are bifurcated, having blades diverging from each other, and inclined to the central plane of the cream box.

A new Horse Hay Rake, the invention of Mr. J. C. Holton, of Owensborough, Ky., is intended for operating on uneven ground with the same facility as upon a level. The novelty consists in the mode of combination of the rake, connecting rod, and lever with the axle and beam.

A Farm Gate invented by Mr. Wm. C. Hooker, of Abingdon, Ill., is so constructed as to be opened or closed by a person on horseback or in a vehicle, by pulling a cord carried over the road at such a distance as to allow room for the horse or vehicle. The gate also locks itself when closed.

Mr. David L. Garver, of Hart, Mich., has invented an improved Harrow Tooth, which is hinged upon a beam and is pressed downward by a torsional spiral spring coiled upon the hinge bolt. In case the tooth should meet an obstruction the spring permits it to yield, and afterward the tooth resumes its normal position.

An improvement in Iron Beam Plows has been patented by Messrs. E. H. Babcock, J. C. Whiting, and O. H. Chamberlain, of Canandaigua, N. Y. The plow beam has a slotted plate, corresponding to a similar one on the standard. The plates, and consequently the beam and standard, are held together by a pivot bolt, clamping bolt, and eccentric pin.

Mr. Edward R. Carr, of Avon, Ill., has invented an improved Check Row Attachment for Corn Planters, for the purpose of marking the ground where the seed is planted, so that the planting may be done in regular check row.

Mr. Wm. E. Harwell, of Starrsville, Ga., has invented an improved Feeder for Thrashing Machines, constructed so as to carry the grain forward on an endless apron, cut the bands with revolving knives, spread the grain by means of toothed drums, and so deliver it to the thrasher in proper condition.

A Grain Binder invented by Mr. Frank E. McNall, of West Henrietta, N. Y., is designed for attachment to a harvester to bind the grain with twine, forming a hard knot, which is not liable to slip. The cord is led by a needle, then seized by jaws, made into a loop by a revolving tube, cut above the knot, and the loop brushed off the tube into position.

Mr. J. C. Slaughter, of Crumpton, Md., has patented an improved Fruit Drier, in which the draught is regulated and equalized by a peculiar arrangement of flues. The fruit is contained in frames having wire gauze bottoms. By means of hooks and a windlass the frames already in the drier are raised and held in place by a ratchet and pawl, so that the trays containing fresh fruit may be inserted at the bottom. As the operation progresses the series of trays thus move upward, and the fruit when perfectly dried is removed through doors at the top of the furnace.

A Combined Drill and Planter has been recently patented by Mr. G. W. Grimes, of Bluffton, Ind. It has a fixed perforated plate at the bottom of the hopper, and a revolving plate, also perforated, which is actuated by a shaft geared by intermeshing wheels to the drive wheel. This shaft can be thrown out of gear when desired by a lever at the handle. The drive wheel acts also as a roller for covering the seed after planting. The point of draught attachment may be raised or lowered, thus assisting in regulating the depth of the drill.

Mr. T. C. Histed, of Salina, Kan., has invented an improved Fanning Mill for Separating Grain, which has a combination with a fan and rotary riddle of curved deflectors arranged so as to direct the blast into the open end of the riddle. The vibratory shaft which carries the sifting screen may be inclined at various angles by an arrangement of slots and pins. The remainder of the apparatus is substantially as in other grain separators, although the details are varied to meet the new features.

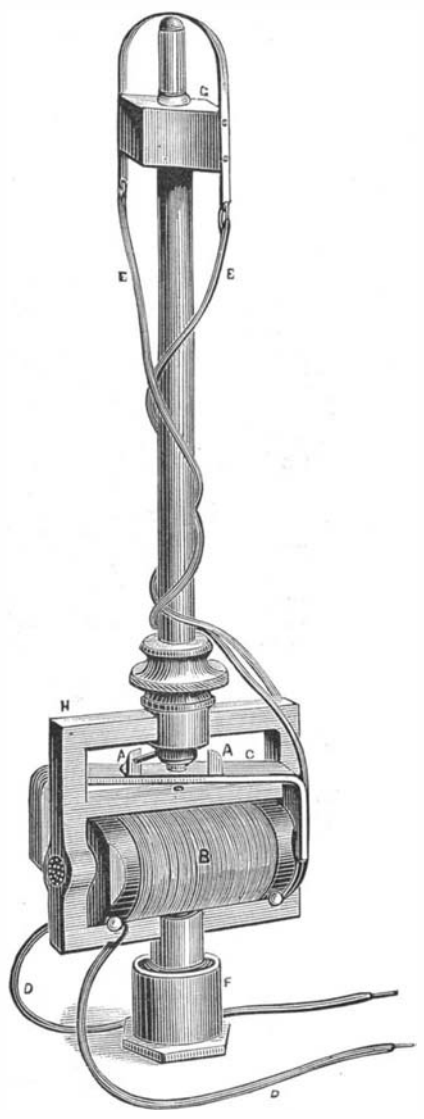
Mr. Albert Tschop, of Harrisburg, Pa., has made certain improvements in Horse Hay Rakes, which consist mainly in means for strengthening the axle and axle arms, in the manner in which the rake teeth are secured to the frame, and in the arrangement for raising and lowering the rakes.

Poisonous Wall Paper.

The frequent warnings given to the public during the past few years against the use of green wall paper (the colors of which are usually arsenical) have produced the popular impression that in the selection of paper for interior decoration this color was the sole one to be feared. But in a lecture on "Poisonous Wall Paper," delivered a short time since before the Manchester Chemists' and Druggists' Association, by Mr. Siebold, the lecturer stated that out of sixty or seventy papers of various colors—blue, red, brown, pink, etc.—analyzed by him, ten only were harmless, the rest containing arsenic. The result, therefore, of Mr. Siebold's investigations should have the effect of rendering heads of families suspicious of some of the most innocent looking colors.

AUTOMATIC GAS LIGHTING.

A new plan for lighting and extinguishing the street lamps by electricity has lately been tested by one of the London gas companies with results which point to a still more extensive trial. The system is one in which electric currents are made to turn the gas on, light it, and subsequently turn it off. Although three operations are thus involved the arrangement is remarkably simple. A single wire may be carried along a line of lamps and then connected with the earth, or the wire may be carried around through a circuit of lamps, so as to terminate at the station from which it started. At this station there would be a magneto-electric apparatus for generating the required currents, and one operator at this point would be able to command a number of circuits, each comprising any number of lamps up to 300 or more.



FOX'S GAS LIGHTER.

The experiments alluded to were made on the premises of the company, and have been published by *The Engineer*. A single line of wire, about half a mile long, was conveyed by a zigzag course along a series of twenty-three lamps. The wire was chiefly an aërial line, suspended to the lamp posts and attached to various intervening structures. It was insulated only at those points where it would otherwise come in contact with some conducting substance. The mechanism applied to each lamp, in addition to the wires, is contained in a small metallic box of circular form, so arranged as not to obstruct the light.

The accompanying engraving shows the mechanical arrangement. The socket, F, is screwed on the top of the gas pipe, and the frame, H, is made hollow for the purpose of allowing the gas to flow up to the nipple at the summit. The gas is turned on or off by means of a valve or stop cock, the lever of which is shown caught by one of the studs, A. The two studs, A A, are borne on the upper part of the permanent horseshoe magnet, C, the latter being supported on the point of a fine pivot working in a cross piece in the frame, H. This permanent magnet is capable of a reciprocating motion horizontally, and supposing its position in the drawing to be reversed, the other stud, A, would carry the pin or lever back through a short space. This shifting of the lever one way or the other serves to turn the gas either on or off, as may be desired. The movement of the magnet is effected by a change in the polarity of an electro-magnet consisting of a soft iron wire in a coil at B. According as the current is sent forward or backward through the coil, so the polarity of the core is altered and the permanent magnet is turned on its pivot. The electric current is conveyed from the magneto-electric machine at the station by the wire, D D, which connects all the lamps. Supposing the current to be sent in such a direction as to turn the gas on, the next operation consists in transmitting along the wire, D D, a powerful discharge obtained from a condenser raised to an electro-motive power of several thousand volts or units by means of a Ruhmkorff coil. Around the primary coil at B is wound a secondary coil of fine wire and of much greater length. The discharge from the condenser has the effect of producing a secondary current along the wire, E E, thereby developing a small spark just over the burner. The discharge which passes along the primary wire has the same effect simultaneously on the secondary wire in all the lamps of the circuit, so that the gas being previously turned on in the manner described, the whole of the lamps are lit. If the first and last lamps of the circuit are in sight of the station the continuity of the circuit will be proved by the lighting of these two lamps. When it is required to extinguish the lights a reverse current is sent through the primary wire, causing the permanent magnet to turn and the gas to be shut off, as described above.

Cotton Seed Hulls as a Non-Conductor.

Mr. Caleb G. Forshey of New Orleans, La., writes us as follows: Three years ago, I induced General Beauregard, who was President and Superintendent of the Carrollton Railroad Company, to try cotton seed hulls as a non-conductor of heat on one of his fireless engines. The tank or receiver of steam was covered about 2 inches or less with the material, confined to it with canvas. It answered the purpose so well that he applied it to the other dummies, coating them with canvas, sheet iron, or wood lagging. An examination recently made showed the hulls unimpaired as a non-conductor. They were colored brown for one third of an inch, but not materially charred, though they had been exposed for nearly three years to a temperature of 360 degrees. Practically they are indestructible at the temperature of steam in boilers.

The experiments I have made upon asbestos, felting, and cotton seed hulls, and other materials, have been very numerous, but they are comparative rather than absolute. They were chiefly upon the bare surface of boilers in use, of 360° external temperature, and subjecting all the materials used to the same test and same circumstances. These are a fair abstract:

Asbestos, 2 inches thick, 202°; hair felting, 2 inches thick, 120°; cotton seed hulls, 2 inches thick, with plaster of Paris, 110°; cotton seed hulls, simple, 2 inches, 103°; cotton seed hulls, simple, 3 inches, 100°.

Rate of radiation: Asbestos, temperature rose from 100°, 10° in 30′; cotton seed hulls, from 100°, 10° in 360′. Felting not fairly tested for rate of radiation.

On August 27 I tested all the dummies while in use. They gave outside the sheet iron or covering, 89°, 89°, 89⅛°, 90°, 90°, 91°, 91⅛°, 92°, 92°. The atmospheric temperature at the same time was 87°.

Utilization of Sewage.—Native Guano.

It may be within the recollection of many of our readers that to a public English company was accorded the privilege of treating the sewage from the City of London, England, by a certain process by which the bulk was rendered inodorous, and in that condition run into the river Thames at certain seasons of the tide, and the balance remaining was preserved and converted into a valuable manure, or native guano, as it was styled.

It appeared at the end of the trial that the Chief Engineer of the London Metropolitan Board of Works reported unfavorably on the whole matter, on account of the expense attending the process; in other words, it did not pay. It was, however, admitted that in a sanitary point of view a success had been attained.

Mr. C. Ramison, the manager of the said company, writes to an English paper that the previous objection as to expense does not now exist, as it has been reduced by two thirds, so that for one third of the original cost the same work can be done. This reduction consists both in the reduced price of the chemicals and in the drying arrangements.

It is stated that the whole process is absolutely free from nuisance from beginning to end, while the crops grown with the native guano on the little farm surprised all who saw them by their luxuriousness and large yield.

Surely these results are worthy the attention of our American scientific engineers. They could doubtless devise some precipitating process by which the immense amount of valuable manure could be saved, and the sewage sent into the rivers in a bright innocuous condition.

The Virginia Meteor.

It appears from the investigations of Professor J. L. Campbell, of Washington and Lee University, in respect to the great meteor which was seen in many parts of Virginia on the afternoon of November 20, 1877, that its height, estimated approximately, was about 100 miles. Its course was 8° or 10° west of north. It exploded over the southeast corner of Halifax county, about 15 or 20 miles a little south of west from Clarksville, 100 miles from Richmond, 80 from Lexington, and 55 from Raleigh. It was a meteor of unusual size and brilliancy, and detonated loudly when it exploded.

GERMANY makes one half of the phosphorus consumed in the world, or over 250 tons annually.

© 1878 SCIENTIFIC AMERICAN, INC

New Mechanical Inventions.

Mr. Geo Bisset, of Quebec, Canada, has invented a Collapsible Core Barrel for casting water, gas, and other pipes. The shell of the core barrel is formed of four cylindrical segments, in pairs of unequal size, the edges of the larger pair overlapping those of the smaller. By a system of wedges and adjusting bolts, these segments are expanded and the loam applied. After the casting has had time to set the wedges are withdrawn and the segments of the shell contract. The inventor claims that much less loam need be used in his apparatus than in the ordinary way.

Mr. J. W. Reed, of Kalamazoo, Mich., has invented an improved Lubricator, having a reservoir mounted upon a stop cock, arranged so that, on steam being let into the reservoir the water condensed displaces the oil and forces it into a tube leading to the parts to be lubricated. Steam may be shut off from the reservoir and the water allowed to run out when it is desired to fill the reservoir with oil; and by turning the stop cock dirt may be blown off by steam.

A Can-Sealing Apparatus, invented by Mr. Thos. Bown, of South Charleston, Ohio, has a rotating table, to which the can is secured by springs, a clamp for holding the cover in place, and a swinging vessel, in which the melted solder or wax are contained, and from which they are poured.

A new Treadle Motion, for operating light machinery, has been patented by Messrs. T. F. Woodbridge and A. P. Gerlach, of Mendota, Ill. There are two pulleys connected with treadles by a single belt, in combination with ratcheted hubs, which act on the pulleys by means of spring pawls.

Mr. E. B. Beach, of West Meriden, Conn., has made improvements in the Bearings of Sheaves and Pulleys, which consist in the adoption of a center pin secured detachably to hanger or block, having a wooden sleeve, which is soaked in oil interposed between the pulley and pin. This arrangement is especially adapted to such pulleys and sheaves as are much exposed to the weather, and is designed to make them last longer and to obviate creaking.

A Windwheel Governor, invented by Mr. James Phillips, of Jewell City, Kan., consists of an arrangement of levers for turning the wings to and from the wind, and actuated by a disk which, under the pressure of a strong wind, causes the wings to present less surface, and in lighter airs to expose the most effective space. Windmills to which this governor is applied have also a vane to regulate the direction, as usual.

Mr. Royal Beal, of Orfordville, N. H., has invented an improved Lathe for Turning Round and Polygonal Bodies. It has a revolving sectional cutter and slowly revolving cylinder, to which a number of wooden blanks are secured equidistant from the center by chucks. The blanks are turned by ratchets and a spring pawl, so as to expose, after each revolution of the cylinder, a new side of the blanks to the action of the cutter, according to the number of teeth of the ratchets and number of sides to be produced. For turning round bodies the cylinder is thrown out of gear and locked into fixed position.

An improved Stamp Canceler, invented by Mr. H. A. Coats, of Wellsville, N. Y., in addition to the ordinary postmarking stamp, has a rotating canceling attachment which perforates or rubs off the printing of the stamp, so as to disfigure it. The head of the canceling attachment may be made of steel faced with emery, or provided with diamond points.

A combined Tire Bolt Holder and Clamping Tool, for the use of blacksmiths and carriage makers, has been patented by Messrs. F. Norris and C. E. Sweet, of Wappinger's Falls, N. Y. It has a solid frame having a fixed fork at one end, with a screw for adjusting a movable standard, worked by a hand wheel at the other end. The standard has a conical teat at the top for bearing on the tire bolt, a recess with clamp screw for holding the shaft, and a bottom rest piece for securing the clips to their connecting clip bars. The tool is intended to hold tire bolts while their nuts are being screwed on, to couple shafts into position on the axles, for putting on the clip bars of axle clips, and for clamping purposes generally.

Mr. J. J. Anthony, of Sharon Springs, N. Y., has invented an Automatic Car Coupling, having laterally hooked draw bars, which are pivoted to the frames of the car, and are the same for each end of a car. They are caused to engage by springs, and are uncoupled by a lever, which may be actuated by a rope from the engine cab. The hooked portions of the draw bars are made sufficiently deep to answer for freight cars of varying heights.

Mr. Chas. P. Kammerer, of Drums, Pa., has invented an improved Feed Regulator for Millstones, in which the hopper leads to an upright tube having a conical bottom, with apertures at opposite sides of its lower end. A revolving shaft carries wings, which mix the grain and push out heads and straws. A movable sleeve, on the outside of the tube, regulates the size of the discharge openings.

Mr. Frank B. Davis, of Johnstown, Pa., has invented a Nut Lock for securing the nuts and bolts used in fish plates or splice bars of rails. The bolt itself is kept from turning by being made to rest with one side of the head flush against a shoulder on the splice bar. The nut is locked in position by driving a wedge between its lower face and a shoulder upon the splice bar on that side, or upon a washer if preferred. This wedge works in a groove, preventing lateral motion, and is kept from sliding out by having its thin end turned up on the side of the nut.

Mr. John F. Taylor, of Charleston, S. C., has made an improvement in Steam and Hydraulic Presses, which consists in adding as many upright parts as one set of horizontal cylinders will supply, each connected with pipes and having a suitable valve to maintain the pressure while the power is applied to the other parts, by raising which valve the press will be lowered.

A new Machine for Cutting Down from Feathers has recently been patented by Mr. Chas. Ballinger, of White Mills, Pa. The apparatus consists of a revolving drum of wire gauze, with an interior reciprocating stirrer and exterior guide bands, through which the feathers are fed. By agitation the stems of the feathers, being heavier, fall through the meshes at the bottom of the drum, when they are seized by reciprocating grippers and drawn between revolving and fixed knives, which strip off the down from the stems.

Mr. Chas. G. Purdy, of New York city, has invented a Machine for Polishing Mouldings, which has a movable bed for carrying the mouldings, placed upon suitable ways and moved by the mechanical device known as "lazy tongs." The object is to secure the required stroke without complicated machinery, the power being applied by a short lever worked by hand or steam, the motion under the polisher being proportionate to the number of joints in the lazy tongs.

A new Lifting Jack, recently patented by Messrs. S., D., J. & L. Barrow, of Windfall, Ind., is adapted to the gradual lowering of a load as well as lifting, and is so constructed as to be applicable to cider and other presses.

Mr. A. M. Buchanan, of Moberly, Mo., has invented a Lever Power Velocipede, in which the weight of the operator is the propelling power. By throwing the weight alternately upon the foot rests, levers are actuated, and these act upon the driving wheels by cog gearing. The velocipede is four-wheeled, and the steering is done by hand.

Mr. R. J. Parrett, of Albany, Ind., has invented an improved Carpet Stretcher, having a foot piece between two arms, the latter worked independently of each other by separate ratchets, pawls, and levers.

A Fuel Press, intended for compressing straw, corn stalks, and other material into a shape suitable for fuel, is the invention of Mr. Nathan Aldrich, of Alden, Iowa. It has two concave rolls, a feeding funnel, and a discharge tube, in connection with a knife for cutting the material into suitable lengths after it emerges from the press.

Mr. Daniel Border, of Bedford, Pa., has recently patented an improved Lock and Key, the former having two opposite tumblers, one above and the other below the bolt, and the key having a fixed and a movable blade, both of which are upon the same side of the shank when the key is introduced into the lock, but are afterward shifted so that they are opposite and may simultaneously engage the upper and lower tumblers.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, March 2, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	6 10 mo.	Saturn sets	6 33 eve.
Venus rises	5 20 mo.	Uranus in meridian	11 14 eve.
Mars sets	11 33 eve.	Neptune sets	10 14 eve.
Jupiter rises	4 35 mo.		

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	1 22 mo.	Sirius in meridian	7 57 eve.
Regulus rises	4 36 eve.	Procyon in meridian	8 50 eve.
Spica rises	9 13 eve.	Aldebaran in meridian	5 47 eve.
Altair rises	2 35 mo.	Arcturus in meridian	3 30 mo.
Algol (2-4th mg. var.) sets	1 31 mo.	Capella in meridian	6 25 eve.
Vega sets	4 45 eve.	7 stars (cluster) in meridian	4 58 eve.
Alpheratz sets	901 eve.	Betelgeuse in meridian	7 06 eve.
Fomalhaut sets	498 eve.	Rigel in meridian	6 2 eve.

REMARKS.

Venus rises 1h. 14m. before the sun, and sets 16m. before the ending of twilight. She can, nevertheless, be seen, as she has an altitude at sunrise of 13° 15′. As she is only 10 days from inferior conjunction, she will appear as a large crescent, only $\frac{1}{25}$ of her illuminated disk being visible.

Mars is in *Aries*, nearly in the sun's path, and southwest of the Pleiades about 10°. Jupiter is also nearly in the ecliptic, and is in the constellation *Sagittarius*, 5° almost directly south of the three stars in the horn of the goat. Saturn sets 1h. 20m. after the sun, just as twilight ceases, and 2° 25′ 56″ north of the sunset point. The southern and illumined surface of the rings is now presented to the earth, and in a few days we may expect to see them, as they appeared when we last saw them, as two small handles projecting from opposite limbs of his disk. He is fast approaching the sun, being in conjunction March 13.

Algol is at minimum brilliancy March 3, 9h. 26m. evening, setting the following morning at 1h. 21m. 45 sec., 58° 57′ 10″ north of the west point of the horizon. As Algol is almost in the zenith at southing (¼° south), and as it takes 9h. 9m. for it to pass from the meridian to the horizon, at the time of minimum the star will be about half way between the zenith and the horizon at the point where it will set. It commences to grow dim 1h. 46m. after its meridian passage, or 6h. 4m. evening, and regains its original brilliancy at 0h. 48m. morning of the 4th. Twilight is shortest March 4, after which time it will increase.

SIR THOMAS BIDDULPH, at the request of the Queen, has written to Professor A. Graham Bell, expressing the wish of Her Majesty to purchase the two instruments (telephones) used recently at Osborne. In reply, Professor Bell asks permission to offer the Queen a set of telephones made expressly for Her Majesty's use.

Fighting the Apple Worm.

In the SCIENTIFIC AMERICAN of February 16, page 103, appeared an illustration of the codling moth and its larva, the apple worm (*Carpocapsa pomonella*), together with a method of destroying the latter, which consists, briefly, in cutting off the calyx of the fruit, where the moth deposits its eggs, as soon as the apple has attained the size of a hazel or walnut. Mr. P. H. Foster, of Babylon, L. I., writes us that he has tried this plan upon Bartlett pears, which are also infested with this plague, but prefers another mode, which he describes as follows:

"After the worm has entered the fruit and accomplished its damage, the time arrives when it has to leave the fruit and hide itself in a quiet, secure position to undergo the transition from the larva to the pupa state, which requires, in the early part of the season, eight or ten days; after this time the miller is hatched and is again ready to besiege the fruit with its sting. The insect, being two-brooded in this climate at least, if not disturbed, has an aggregating force to do mischief the second time. The progeny for the succeeding year have alone to depend on the security of this second generation of larvæ. As they may often be found in bark of apple trees during winter, my plan of destruction is, about the first of July to take woolen rags large enough to wrap around the trees, and say 4 inches wide. Each week I look over the trees and destroy the worms secreted under the rags, and wherever I find them, until the fruit is off the trees. I have all the green fruit, of every kind, carefully picked up as soon as it falls, thereby destroying many of the curculio as well as the apple worms. In future I intend to poison the rags made use of to capture the insect."

Mr. Foster estimates that the ravages of this pest cause a loss to the fruit growers of the United States fully equal to 5 per cent interest on the national debt, a statement which shows the importance of an effective remedy.

If the Temperature of our Earth should be Changed.

M. Dumas, before making known to the French Academy the important results obtained almost simultaneously by M. L. Cailletet and M. Raoul Pictet, on liquefaction of oxygen, read the following extract from the works of Lavoisier ("Recueil des Mémoires de Chimie de Lavoisier; Œuvres de Lavoisier publiés par le Ministère de l'Instruction publique," t. ii., p. 804). This passage shows how the immortal creator of modern chemistry foresaw the facts which have been subsequently realized by Faraday and his successors: "Let us reflect for a moment what would happen to the different substances composing the globe if its temperature were suddenly changed. Suppose, for instance, that the earth were transported at once into a much hotter region of the solar system—into a region where the average temperature were much higher than that of boiling water—very soon the water, and all other liquids capable of evaporation at temperatures bordering upon that of boiling water, and even certain metallic substances, would expand, and become transformed into aëriform fluids, which would then become part of the atmosphere. On the contrary, if the earth were suddenly placed in very cold regions—for instance, in those of Jupiter or Saturn—the water which at present forms our rivers and seas, and probably the greater number of the liquids which we know, would be transformed into solid mountains. On this supposition the air, or at least a part of the aëriform substances which compose it, would doubtless cease to exist in the state of an invisible fluid for want of a sufficient degree of heat; it would return to the state of liquidity, and this change would produce new liquids of which we have no idea."

Scientific American.

No publication comes to our table that is more highly prized than this old, substantial journal. Aside from keeping the public fully posted respecting new inventions and scientific developments, it contains a vast amount of the practical and useful. The engravings are of remarkably high order, and matter accompanying them is so tersely put that such subjects as might, under ordinary circumstances, be considered dry and heavy, are not only readable, but highly enjoyable. It is the best conducted scientific journal in the United States, as well as being typographically the handsomest. As evidence of this it is only necessary to say its circulation is double all the others combined. It is in its 37th volume. Subscription price $3.20. Munn & Co., 37 Park Row, New York.—*In Door and Out.*

Nitro-Glycerin.

MM. A. Sauer and E. Ader give in *La Nature* details of an investigation for the determination of the nitrogen in nitro-glycerin. Their results show that the nitro-glycerin of commerce, such as is contained in dynamite, is not a mixture of mono, bi, and tri-nitro-glycerin as commonly supposed, but is formed exclusively of tri-nitro-glycerin; and second, that the method of decomposition by alcoholic potash does not yield niter alone, but ammonia also, and, therefore, that Dumas's method should be employed for determining the proportion of nitrogen in nitro-glycerin.

Detecting Glycerin in Beer.

The German Society for the Encouragement of Industry offers a reward of $720 for a means of determining (within 25 per cent) the quantity of glycerin contained in beer. Glycerin, it is found, is largely used to adulterate beer, and the brewers, considering that the fact injures their trade, are desirous of a simple and speedy method for its detection.

© 1878 SCIENTIFIC AMERICAN, INC

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

For the best and cheapest Steam Pump, address National Steam Pump Co., 46 Cortlandt St., N. Y.

Alcott's Turbine received the Centennial Medal.

Wanted.—Tools for Sewing Machine Factory. T. Shanks, Baltimore, Md.

A 5 Horse Caloric Engine for sale on account of removal for $400, cost $1,200. Now running at 8 Cortlandt St., N. Y., up stairs.

Wanted.—An economical Spring Motor from one man to one horse power. Inventors or manufacturers address Wm. Pettet, 60 Warren St., N. Y.

Safety Linen Hose for factories, hotels, and stores, at lowest rates. Greene, Tweed & Co., 18 Park Place, N.Y.

For Sale at a bargain.—One 5ft. 24 in. sq. Iron Planer; one Prouty Chuck fitted 30 and tools. Address W. E. Lewis, Cleveland, O.

Experienced Superintendent in Hydraulics, Steam, Sugar, and General Machinery; educated, influential, prompt, systematic; wants position; any manufacturing business, even as foreman. Address 35 B'way, N.Y. room 99.

Wanted.—A party with some capital to conduct a first-class Woolen Mill at Fredericksburg, Va. Address L. S. White, Baltimore, Md.

Telephone.—Researches in Electric Telephony. Profusely illustrated; 8vo., sewed; 60 cents, mail free. E. & F. N. Spon, 446 Broome St., N. Y.

For Telephone Experiments, supplies of all kinds. Electric Supply Co., P. O. Box 611, Providence, R. I.

Machine Shop for rent, Tools, etc. for sale—Engines, Boilers, Lathes, Planer, Small Tools, etc.—$1,200 cash. Address 1,600 N. Front St., Philadelphia, Pa.

For Sale.—One new No. 3 Pearl Printing Press, 7x11, foot and power; cost $130, will sell for $100. Address W. E. Lewis, Cleveland, O.

Walrath's Improved Portable Engines best in market; 3 to 8 H. P. Peter Walrath, Chittenango, N. Y.

Wanted.—A 2d hand Corliss Engine, 14 to 18 in. bore, 30 to 42 in. stroke. Address Brose & Bro., Evansville, Ind.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For book on Lubricants, R. J. Chard, 134 M. Lane, N.Y.

2d Hand Iron Planer built by Smith of Salem. Plane 13 ft. x 30 in.; price $300. A.C. Stebbins, Worcester, Mass.

Cornice Brakes. J. M. Robinson & Co., Cincinnati, O.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel — other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

The Niles Tool Works, Hamilton, O., have second-hand Machine Tools in first class order for sale.

Friction Clutches warranted to drive Circular Log Saws direct on the arbor; can be stopped instantly; also Upright Mill Spindles, Safety Elevators, and Hoisting Machinery. D. Frisbie & Co., New Haven, Conn.

Wanted.—Second-hand Gun Stocking, and other Gun Machinery. Address V. A. King, Lock Box 81, New Haven, Conn.

Bound Volumes of the Scientific American.—I have on hand about 200 bound volumes of the Scientific American, which I will sell (singly or together) at $1 each, to be sent by express. See advertisement on page 142. John Edwards, P. O. Box 773, N. Y.

A. L. Jones' Steam Trap most reliable one made. W. E. Kelly & Bro., 46 Cortlandt St., N. Y.

Wanted.—A strictly reliable Manufacturing Company to take charge of manufacture and sale of Lempert's Faucet—see Scientific American of Dec. 8, 1877—or purchaser for Patent Rights. W. S. Lempert, Fort Davis, Texas.

Manufacturers should try the pure natural Lubricating oil. Produced and prepared by Geo. Allen, 13th street, Franklin, Pa. It does not gum or chill in cold weather, and wears as well as lard oil. Price by the barrel 30 cents per gallon. Packages of 10 gallons sent on receipt of $3.75.

For the best Bone Mill and Mineral Crushing Machines—five sizes, great variety of work—address Baugh & Sons, Philadelphia, Pa.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years' constant use proves them stronger and more durable than wrought iron. See advertisement, page 142.

Galvanized Iron Cornice Machines.—The most Improved, Straight and Circular. Prices reduced. Calvin Carr, Cleveland, O., and Hewes Machine Works, Newark, N. J.

Polishing Supplies of all kinds. Walrus Leather Wheels, all sizes and shapes. Greene, Tweed & Co., N.Y.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (New List.) D. Gilbert & Son., 212 Chester St., Phila., Pa.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

Lansdell & Leng's Lever and Cam Gate Valves. Cheapest and best. Leng & Ogden, 212 Pearl St., N. Y.

Best Machinists' Tools. Pratt & Whitney, Hartford, Ct.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

NEW BOOKS AND PUBLICATIONS.

HEATING BY STEAM. By John H. Mills. Published by the Mills Steam Heating Trust Association, Boston, Mass.

This volume, besides containing a number of useful tables and much valuable data relative to its subject, explains the advantages of improved systems of steam and water piping for buildings devised by its author. It is well illustrated.

THE AMERICAN NEWSPAPER DIRECTORY. January, 1878. Geo. P. Rowell & Co., Publishers, 10 Spruce street, New York city. Price 50 cents. $1.50 per year.

Instead of publishing their valuable newspaper directory yearly, as a single high priced book, Messrs. Rowell & Co. propose hereafter to issue it in quarterly numbers and in cheaper form. The useful information hitherto found in the work will be in no respect lessened or decreased in value, the necessary retrenchments being effected through the use of smaller type and less expensive mounting; while through the more frequent issue the contents will be corrected up to later dates. The present number contains the usual complete lists of papers arranged in accordance with location, circulation, etc., and the book is excellently adapted to fulfill its purpose as a moderate priced reliable guide for the advertiser.

AN AMERICAN ALMANAC AND TREASURY OF FACTS FOR THE YEAR 1878. Edited by Ainsworth R. Spofford, Librarian of Congress. Published by the American News Company, New York city.

Mr. Spofford has collected in this manual an immense amount of just such statistical, financial, and political information as every one wishes to have ready at hand for easy reference. The book is capitally well edited, and in the full discussions which it contains on the important questions of the day, notably on strikes, savings banks, the silver problem, etc., it will be found exceedingly valuable as a guide to a clear comprehension of the considerations involved. Beginning with an almanac for the year, it contains a full list of American libraries, interest tables, record of the Centennial Exhibition, history of the income tax, electoral votes for all elections, prices of commodities, national receipts and expenditures, imports and exports, the Constitution, lists of public officials, statistics of population, manufactures, fire insurance, land grants, railroads, etc., besides a large amount of valuable miscellaneous information from reliable sources.

MONEY AND ITS LAWS. By Henry V. Poor. Published by H. V. and H. W. Poor, 68 Broadway, New York city.

An exhaustive and elaborate exposition of the laws of money, treated as coming within the range of the exact sciences, and forming a work which will doubtless remain as a standard with those who agree with its opinions. It is divided into three sections. Under the first the laws of money proper are considered, and the reader is supplied with a clear foundation of general theory which will enable him intelligently to compare and contrast the various monetary theories, which are elucidated with much care in the ensuing division of the work. Beginning with those of Aristotle, the writer examines in turn those of Locke, Law, Hume, Adam Smith, Dugald Stewart, and concludes with such modern writers as Professor Francis Bowen, W. G. Sumner, Bonamy Price, A. R. Perry, and D. A. Wells, from the views of all of whom he vigorously dissents. The remainder of the work is devoted to a history of currency and banking in the United States.

We have received from Messrs. Scribner, Armstrong & Co. Part II. of "Upland Game Birds and Water Fowl of the United States," which contains two fine reproductions in water color of sketches of the mallard duck and woodcock, besides interesting descriptive matter. This splendid work is being issued by subscription only, at $2.50 per part. Each part (there are ten in all) contains two colored plates, reproduced as perfectly and as elegantly as the art of printing will allow. The letter press accompanying, a model of fine typography, is taken from the works of Wilson, Audubon, Coues, and other standard ornithological authorities.

Notes & Queries

G. C. P. should state whether it is soft iron or other metal which he requires.—T. S. will find the required information on p. 272 of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 17.—L. P. H. is referred to answer to G. E. S., p. 268, of SCIENTIFIC AMERICAN, October 27, 1877.—J. S. F.'s questions are too indefinite.—S. M. L. may obtain a hint from pumps of the kind already in the market, but his questions are rather matters of experiment than of rule.—A., J. & W. are referred to a discussion published in vol. 30 of the Proceedings of the Institution of Civil Engineers. The points are still in controversy.—J. W.—A good way to discover where the stoppage occurs is to drill small holes in the pipe at intervals. Probably there is some point where air is confined, or some other obstruction. —The data furnished by J. W. A. are too incomplete. —The book which C. H. requires is yet to be written.—W. M. K. should explain what he means by "force of momentum."

(1) C. H. has a lot of tobacco which is too strong to smoke in a pipe, and wishes to know if there is a cheap and easy way of curing it. A. We know of none. The proper way to utilize it would be to adopt the method practiced by dealers—mix it intimately with tobacco which is extremely mild.

(2) L. P. C. wants to know "from the consideration of what principle we derive the notion of the existence of an absolute zero in the thermometer, and how it is found." A. The zero of a thermometric scale has no relation to the real zero of heat, or the point at which bodies are entirely deprived of heat. Of this point we know nothing, and there is no reason to suppose that we have ever approached it. In graduating thermometers, the bulb is plunged into melting snow or ice, and the point at which the mercury remains stationary is marked on the tube with a file; another fixed point is obtained by immersing the bulb in boiling water. The space between these two points is then divided off into equal parts. In the Réaumur and the centigrade thermometer the freezing point is made zero, the former being divided into 80 parts and the latter into 100. Fahrenheit's thermometer commences counting, very singularly, not at the freezing point, but 32° below it.

(3) A. P. M. asks: What will remove the stains, caused by wire around flowers, from glass vases? The wire rusting in the water discolors the glass. What will remove the discoloration? A. Nitric acid of the ordinary commercial strength will remove iron rust from either glass or earthenware. It may be applied by means of a rag tied on the end of a stick, great care being taken that the acid does not touch the skin or clothing.

(4) C. H. I. asks: What is the least length and weight of (insulated) wire that can be used in a coil for a Bell telephone? A. The smallest working telephone we have seen is of about the size of the cut, Fig. 1, p. 207, of the SCIENTIFIC AMERICAN, No. 14, vol. 37, and the magnet wire occupied about the space shown at B in that cut.

(5) E. C. N. writes: 1. I have a lot of carbon taken from gas retorts. Can it be used for galvanic cells? A. Yes. 2. What is the best way to make a spark generator? A. See answer to G. N. L., No. 4, p. 251, of SCIENTIFIC AMERICAN, October 20, 1877. 3. How many gravity cells are required to light 10 or 15 gas lamps? A. About 4 one-gallon cells.

(6) W. H. C. asks: 1. Is it advisable to mix plumbago with the oil or tallow for use in the cylinder and steam chest of slide valve engines, and on journals, bearings, etc.? Does it not cause greater wear than a pure article of lard or sperm oil alone? A. It is not generally considered advantageous to mix plumbago with other lubricants for working parts of iron or steel. 2. Should it be used in oil to decrease friction and wear of journals, valve seats, etc.? A. Upon this point there is a difference of opinion, but plumbago is rarely used. 3. What should be the proportion to oil? A. The quantity is variable, some using as much as the oil will take up without losing its fluidity.

(7) I. A. T. writes: 1. I intend putting up half a mile of telegraph wire. Will No. 18 common iron wire do? A. Yes. 2. I have one line of No. 18 wire up now, but it will not work. What is the difficulty, and will a return wire prevent it? A. The fault may be that your earth connection is insufficient; use the gas or water pipes as an earth connection; but if in your neighborhood there are no pipes laid in the earth, then it would be better for you to use a return wire.

(8) D. H. T. asks: If two pieces of sheet lead, about the size and thickness of a card, be placed ⅛ inch apart, the backs and edges covered with wax, can the space between be filled with copper solidly by electro-deposition? A. No one but a thorough expert could do this, and even then the copper deposit would very likely be porous and granular.

(9) L. S. M. asks: What is the composition of emery wheels? A. Those now in use are composed mainly as follows: 1, hard rubber; 2, chemical charcoal and glue; 3, shellac, linseed oil, and litharge; 4, glue, linseed oil, and litharge; 5, silicate of soda and chloride of calcium; 6, celluloid; 7, oxychloride of magnesia; 8, infusoria; 9, glue. Nos. 4, 5, and 7 are tamped or rammed.

(10) J. H. asks: 1. At what cost per lb. can copper be electro-deposited on iron? A. That will, of course, depend on many details; but if it is done on a large scale, using magneto-electric machines instead of galvanic batteries, then the expense of depositing could be reduced to about 75 cents per lb. 2. Can copper be deposited to a thickness of ¼ or ½ inch, and have a fine, solid surface when polished? A. Yes, by repeatedly burnishing the copper deposit as it becomes thicker.

(11) W. N. P. asks how to find the pitch of bevel gears. A. The pitch line is at the junction of the curve forming the face and that forming the flank of the tooth.

(12) R. C. writes: 1. I think of making a galvanic battery of glass, 5 inches by 8, and 4 inches deep, by cementing the bottom and end joints with putty and covering with shellac, placing it in a wooden box for protection; then placing two copper plates, one on each side, with two zinc plates in the same direction, about the longitudinal center, connecting the copper plates with one wire and the zinc plates with another. Would this arrangement be successful? A. Yes. 2. Would it require insulated wire? A. No. 3. Should the zinc plates be connected to bottom and sides of the glass box? A. No. 4. Would it produce an appreciable shock? A. No. 5. What quantity of sulphate of copper would be required? A. About ½ lb. 6. Could it be arranged in a better way? A. Yes. See answer to G. E. S., SCIENTIFIC AMERICAN, October 27, 1877.

(13) H. G. G. writes: 1. I am making a telephone to work about 200 feet. How much and what size insulated wire shall I use in the coil to make the iron bar a strong enough electro-magnet? A. Use ½ lb. No. 30 insulated wire for each instrument. 2. How large should the bar be? A. The core should be about ⅛ inch round iron. 3. What battery and how many cells will be needed? A. Three one-gallon cells of a gravity battery.

(14) H. K. S. T. writes: Is there any way by which the attractive power of a permanent magnet can be temporarily withdrawn, so that its armature may be removed without the application of a power equal to the attractive power of the magnet? A. Only by placing another armature on the magnet, but even then the attractive power of the magnet should be considered as if it were divided between the two armatures.

(15) R. S. N. asks: 1. How are friction pulleys made to do the best work? A. It depends upon the nature of the work. 2. Can as much power be transmitted by a bevel friction pulley running on a bevel friction pulley of larger size, or a bevel iron pulley, smooth on face, as by the same size cog pinion running in a bevel cog wheel of the same size as the iron pulley? A. No. 3. If not, how can I determine the size and width of face of bevel friction pulleys to transmit a given power? A. It depends upon the kind of friction gear employed.

1. What is meant by the "lead" of a slide valve, and "cushioning" of valves, pistons, etc., with steam? A. The lead of a slide valve is the amount the steam port is open when the piston is at the end of its stroke. Cushioning is shutting in a portion of the steam on the exhaust side of the piston. 2. Is it necessary that a cylinder in a horizontal engine should wear larger at the middle than at either end? A. It is usually the case.

(16) J. M. C. asks: 1. Is anything to be gained by wetting Scranton coal for stove use, before burning? A. Ordinarily, no. 2. Are coal ashes of any benefit to soil? A. We think not.

(17) T. D. asks: Are rymer, reamer, rimmer, and rimer, one and the same tool? A. Yes.

(18) F. A. asks: What distinguishes a brass from a box or bearing? A. The terms brass or brasses refer to journal boxes fitted to some movable part, as a rod or lever. A box or bearing remains stationary.

(19) L. A. asks: What determines the application of the terms, shaft, axle, spindle, gudgeon, wrist pin, and crank pin? A. There is no rule governing the employment of these terms, but in practice spindle is usually applied to a shaft of small diameter; gudgeon to a short shaft having a journal supported on each side; crank pin is a pin in a crank having journal bearing to connect a rod or lever to. The term wrist pin is applied indiscriminately to gudgeons, crank pins, and pins like crank pins but not held in cranks.

(20) A. W. C. asks how to make the double cyanide of mercury and potassium. A. Dissolve 2 parts potassium ferrocyanide and 3 parts dry mercuric sulphate in 15 parts of water; boil for 15 minutes, filter hot, and, after the solution has cooled, gather and dry the crystals deposited. Dissolve 25 parts (by weight) of these in water, and add 5 parts of potassium cyanide. The solution may be evaporated to dryness.

(21) P. S. asks how to prevent shoes from creaking. A. Soapstone between the soles is a good remedy.

(22) Z. W. asks: How can linen be made uninflammable? A. Steep the cloth for an hour in solution of 1 oz. of common sodium tungstate in a pint of hot water, and dip into hydrochloric acid diluted with 4 parts of water to fix the tungstic acid. If not intended to be washed, the acid treatment may be dispensed with. Or, use a strong aqueous solution of ammonium sulphate and alum, and dry without washing.

(23) W. K. L. asks: How is the rubber cement, used to fasten rubber to leather soles, made? A. Several cements for this purpose are in use. The rubber cement is made by digesting for several days, with occasional stirring, 2 ozs. of gum caoutchouc in a pint of naphtha. It may be concentrated by evaporation over a hot water bath, or diluted by adding more naphtha. The solution is more quickly accomplished if the naphtha is warmed—by hot water or steam—in a strong, airtight vessel.

(24) A. C. P. writes: 1. In the manufacture of transparent soaps it is directed to use 40 per cent alcohol. What is meant by this—40 per cent by specific gravity, or that 100 ozs. of a mixture of alcohol and water at 60° Fah. contain 60 parts of water and 40 of absolute alcohol? A. 40 per cent spirit contains 40 per cent (by weight) absolute alcohol in 100 parts—alcohol 40, water 60. The strength of spirit is ascertained by means of a hydrometer and alcoholometric tables. The specific gravity of 40 per cent spirit should be 0·9296. 2. Is methyl alcohol a solvent for transparent soaps? A. Try it. 3. It is made 95 per cent; how much dilution with water will bring it to 40 per cent? A. About 137·5 parts.

(25) J. K. S. asks: How can wire traps be tinned smoothly? A. If of brass or copper, boil with a strong aqueous solution of potassic stannate mixed with turnings of tin. Or boil with tin filings and solution of cream of tartar or caustic soda. If of iron, pickle for a short time in dilute oil of vitriol, wash by immersion in a large quantity of water, dry in sawdust, and pass through a bath of molten tin covered with tallow.

(26) D. W. C.—The paper you send is a hand-made, Japanese paper. It is made from the inner bark of the paper mulberry (*Broussonetia papyrifera*). The bark is treated with strong lye to weaken the fibers, then thoroughly washed to remove the alkali, and beaten with heavy sticks on a wooden slab till it assumes a pulpy state. It is then mixed with rice paste, and, on being diffused through water, is ready for the process of paper making. The apparatus for this purpose consists of a mat made of fine bamboo rods lying parallel to each other and bound together by silken fibers, and the whole surrounded by a narrow rim. This mat is dipped into the liquid pulp, withdrawn, and shaken backwards and forwards with short jerks. This insures the even distribution of the pulp and arranges the fibers across the sheet at right angles to the splints. The superfluous water flows away through the interstices of the bamboo. When the paper has reached the desired thickness, by alternate dippings and dryings, it is removed from the mat and laid out to dry. Each sheet is afterward spread out on a smooth board, with a soft flat brush, and dried in the sun. The paper as stripped from the boards is smooth and flat, and only requires the proper trimming to fit it for market.

(27) Speaking of the effect of nickel plating upon the quality of brass musical instruments, previously discussed in these columns, M. S. O. writes that he knows of a Courtois piston-valve trombone whose quality was improved by nickel plating; that judges pronounce the tone actually better than before being plated.

© 1878 SCIENTIFIC AMERICAN, INC

(28) L. G. asks: 1. How can small steel bars be magnetized? A. A simple way is to place each bar in succession on the poles of a powerful electro-magnet, so that the bar to be magnetized will act as an armature to the electro-magnet. Another is the method described in answer No. 16, p. 299, SCIENTIFIC AMERICAN, November 10, 1877. If sufficient battery power be used, the latter method produces the strongest magnets. 2. What should be the temper of bars to be magnetized? A. If the bars are made of Jessop's steel they should be glass hard.

(29) B. P. L. writes: I have a leaky skylight which carpenters and painters have tried in vain to make watertight. Can you advise me how to remedy it? A. The skylight should be very steep, at least equal to an angle of 45°. The glass should be bedded in putty as well as stopped with it on the outside—the bed is likely to stay when the outside putty crumbles off. Iron bars are the best.

(30) A. B. C. asks: What is the method of casting brass plates for rolling into sheets, and how are the moulds dressed to make the plates clean and smooth? A. The metal ingot, or plate, is cast under pressure in metallic moulds, the surfaces of which are highly polished and then smoked by holding over a gas flame.

(31) L. S. K. writes: I wish to construct a telephone, and have procured photographic plates for it. 1. How can I remove the enamel? A. By heat. 2. Is it necessary that the enamel should be removed? A. No. 3. Will I infringe on the Bell patent if I alter the form and retain the plate and magnet? A. Yes.

(32) H. W. B. asks: 1. Are horseshoe magnets charged by an electro-magnet? A. Yes. 2. How large should the electro-magnet be? A. As powerful as can be obtained. 3. How can I tell which is the positive pole of a horseshoe magnet? A. By a compass; if the north pole of the needle is attracted to one pole of the magnet, then that pole is south, because "unlike poles attract."

Why are bits of paper, when thrown into a tumbler of water, attracted to the sides of the vessel? A. They are drawn by the influence of a power called attraction, the same which manifests itself in capillary action, as in raising the oil in the wick of a lamp.

(33) H. F. writes: Our roof was coated with tar, which has been partly scraped off, and now the ordinary paint will not answer well, as the remaining tar is too thick in some places. With what shall I paint the roof? A. Yellow ocher is a finer paint than the ordinary metallic paint. Perhaps a little shellac varnish mixed with it will make it stick to the tar.

(34) J. O. asks how to make a concrete flooring for stables and farmyards. A. To make a permanentpavement, excavate to the depth of 2 feet, and lay in the largest stone you can procure, 1 foot deep. Fill in upon this bed enough small stones of egg size to level it very smooth, carefully filling all the interstices between the large stones. Now procure a quantity of coarse gravel, entirely free from loam, and fill in up to within 6 inches of the surface. Let this remain in this condition until it has undergone a thorough settling and packing by being subjected to a heavy rain. You will now have a solid, substantial bed for your concrete, which may be made as follows: To 3 lbs. of clear sharp sand add 1 barrel of good cement, dry. Thoroughly incorporate, then sprinkle enough water upon the mixture to make a paste, stirring it well. To this paste add 2 barrels of stone chips and 2 barrels of coarse gravel—but only as much, however, as the paste will take up. Mix thoroughly and deposit it immediately on the bed, letting it fall from the barrow, and leveling it off to its proper height. The whole floor should be covered with as little delay as possible, and when laid should be compressed by a rammer such as is used by street pavers. Finish with a thin coat of pure cement mortar, to bring the surface to complete evenness, and do not let it dry too quickly, but wet it occasionally so that it may have all the water it will absorb.

(35) C. E. C. asks: Who is supposed, by the latest standard authorities, to have built the pyramid of Cheops? A. The pyramids are attributed to the three kings of the fourth dynasty—Cheops, Cephren, and Mycerinus.

(36) C. C. P. writes: We have planned to construct a large factory building as follows: The side walls to be built up of 2 by 6 lumber laid broadside down and spiked together, the outside and inside of the walls to be finished with two good coats of water, lime, and sand, keyed on by driving broadheaded nails into the walls. Will the wood thus incased be liable to rot? A. Girders and beams in floors, incased in a similar manner, have been subject to "dry rot."

(37) L. S. writes: I wish to bring water to my house from a spring distant nearly half a mile. There is sufficient fall. Shall I use stone sewer pipe, or would bored pine logs be better? The latter, with 1½ inch bore, can be delivered at 5 cents a foot. Would a pipe made of them be durable? A. At the lower end of the pipe there will be considerable pressure, which would force the joints of the stoneware pipe. The pine logs would answer, if placed low enough in the ground to be always more or less saturated with water as in this condition they are less likely to decay. We have seen spruce logs constituting an old dock taken out of a cellar excavation near the river, which were apparently as sound as they were the day they were put in—which, by the record, was 68 years before. These, however, were constantly immersed in the water, which rose in the ground to within 5 feet of the surface. By putting an iron ferrule on the sleeve end of the log pipe you may drive in the small end sufficiently tight to prevent leaking.

(38) G. D. B. writes: We have in our town a new hall which has an echo. The hall is 75 x 50 feet, and 21 feet high. What will stop the echo? A. See vol. 22, p. 356; vol. 30, pp. 202, 324; also vol. 32, p. 186. Perhaps changing the position of the speaker's desk may improve the sound.

(39) C. G. asks: 1. Should plate glass be bedded when put in? A. Yes; but it is not always done. 2. How is the bedding made? A. Bed with a layer of putty like that used upon the outside.

(40) R. S. N. writes: I wish to build a flat-bottomed boat to carry 100 bales of cotton, and not to draw more than 16 or 18 inches when loaded; to be able to make 4 or 5 miles an hour. Please advise me as to the best plan, whether it is better to have one engine of the necessary power or two engines attached to the wheel with cranks at right angles, and what is the best kind of wheel for shallow water? A. A flat-bottomed boat can be made to draw less water than any other model, but will take more power for the same speed than it would if made with finer lines. We think that a stern wheel driven by two engines will be preferable on some accounts.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Z. W.—It is an impure clay, containing much fine silica and lime carbonate. It might be used for some polishing purposes and for soft bricks.—C. E. B.—It is a quartz sand; the coloring matters are principally iron and manganese oxides.—C. D.—It is itacolumite or flexible sandstone—flexible in thin laminæ. It contains, besides the quartz sand, some talc. It has been used by the marble polisher, and the fine sand obtained by crushing the stone as a flux in certain metallurgical operations (copper smelting, etc.); for the manufacture of artificial stones for architectural, paving, and grinding purposes; as material for crucibles and fireboxes; in the manufacture of cheap glass, and for scouring purposes. The fine sand works well with the sand blast. It may be used as an absorbent in drying substances, such as starch, for retaining corrosive liquids in desiccators, and for the storage of explosive compounds, such as nitro-glycerin.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 22, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Arbor for gardens, I. Clark	199,353
Auger, T. W. Wissinger	199,391
Ax blanks, making, W. Acheson	199,393
Axle boxes, gasket for, G. S. Winslow	199,390
Back and shoulder brace, J. W. Partridge	199,463
Bag holder, A. Brubaker	199,507
Barrel, A. W. Blye	199,405
Bee hive, M. A. & N. J. Carriker	199,513
Binder for letters, H. H. & J. R. Edwards	199,525
Book binding, I. Reynolds (r)	8,056
Book binding, I. Reynolds	199,572
Boot and shoe stiffener, W. H. Richardson	199,574
Boot cleaner, G. F. Blauvelt	199,497
Boot jack, J. B. Lauffer	199,557
Bottle capper, J. Sacksteder	199,581
Brake, A. K. Hadley	199,434
Brake, car, J. and J. G. Hardy	199,540
Brick machine, H. C. Sergeant	199,472
Broom binder, J. W. Cliff	199,412
Buckle, E. S. Smith	199,586
Burial cases, S. Benton	199,495
Burnishing machine, J. Stever	199,592
Butter, artificial, W. E. Andrew (r)	8,048
Can for oysters, J. J. Phillips	199,569
Can soldering apparatus, T. Bown	199,406
Car coupling, H. M. Grover	199,433
Carpet stretcher, R. Parrett	199,462
Carriage, child's, R. G. Britton	199,505
Carriages, holdback attachment, M. W. Spaulding	199,589
Cartridge capping implement, T. M. Wallis	199,600
Chain, J. L. Heeley	199,542
Chair, sewing machine, S. D. Granger	199,585
Chimneys, A. Barnum	199,399
Churn, J. M. Hill	199,547
Churn dasher, G. Sprague	199,474
Clam baker, J. L. Stroub	199,595
Clothes washer, N. H. Long	199,455
Coffee percolator, J. C. Jensen	199,445
Collars, die for making, G. K. Snow (r)	8,046
Cooker, feed, A. Stewart	199,593
Cooler, milk, O. S. Bliss	199,404
Corn husker, G. Meader	199,376
Corn shelling machine, W. M. Blair	199,496
Cornet, C. G. Conn & E. Dupont	199,516
Corset, L. T. Smith	199,587
Corset spring, J. Day	199,417
Cotton sweep, W. W. Speer	199,590
Culinary vessel, O. S. Bliss	199,403
Cultivating implement, W. H. Thomas	199,481
Cultivator, B. F. & L. W. Needham	199,565
Cuspadore, E. A. Heath	199,541
Dental engines, J. W. Gilbert	199,431
Dental engines, J. Re Qua	199,469
Dental engines, E. T. Starr	199,477
Door stop and holder, H. Knowlton	199,451
Drill, rock, E. S. Winchester	199,389
Drilling machine, D. McMurtrie	199,377
Engine regulator, N. G. Herreshoff	199,544
Feather renovator, W. A. Stewart	199,478
Fence, barbed, J. Hallner	199,538
Fence wire retainer, W. P. C. Bain	199,490
File, letter, W. A. Amberg	199,395
File, newspaper, H. S. Williams	199,606
Files, sharpening, M. A. Richardson	199,573
Filter for beer pumps, J. C. A. Rohde	199,577
Filter for houses, air, E. N. Dickerson	199,357
Filter water, J. Crawford	199,519
Fire arm, W. H. Baker (r)	8,053
Fire escape, W. J. Nunn	199,461
Fire escape, F. A. Presko	199,571
Fish hatching apparatus, T. B. Ferguson	199,527
Flue cap, J. D. McLinden	199,458
Fluid meter and motor, E. Anthony	199,397
Fluting machine, G. E. King (r)	8,055
Fork, horse hay, L. W. Noyes	199,378
Furnace, W. F. Flagg	199,529
Furnace and range, J. P. Beck	199,347
Furnace, metallurgic gas, W. S. Gillen	199,362
Furniture structure, C. Kilburn	199,373
Gas from gas wells, preparing, W. S. Gillen	199,368
Gas purifying apparatus, T. N. Kirkham *et al*	199,450
Gas scrubber and washer, J. Balmore	199,492
Gasket, W. Wallace & J. King	199,601
Gate, W. C. Hooker	199,441
Gate, O. L. Taylor	199,480
Gear wheels, moulds for, J. H. Felthousen	199,526
Glass hardening, tempering, etc., F. Siemens	199,583
Glove fastener, J. F. Field	199,528
Governor, wind wheel, J. Phillips	199,464
Grain separator, H. S. Stone	199,594
Grate, shaking, O. P. Jackson	199,552
Hammer, lasting, P. F. Peters	199,568
Harness, J. C. McCollum	199,561
Harrow, M. M. Dobbin	199,421
Harrow tooth, D. L. Garver	199,430
Harvester cutter bar, R. W. Iliff	199,551
Heating air and gases, T. Whitwell	199,388
Heating apparatus, D. Needham	199,564
Heel burnishing machine, J. W. Dodge	199,523
Hides, apparatus for handling, J. T. Gorsline	199,534
Hides, unhairing, scouring, etc., J. A. Talpey	199,597
Hoe, weeding, W. Luckhurst	199,375
Hoop, truss, C. W. Thompson	199,385
Horses, hitching and securing, F. W. Schwiers	199,381
Horseshoe, J. L. Dodge	199,422
Horseshoe nail machine, Wheeler & Loring	199,483
Hose coupling, W. A. Caswell	199,349
Hose, carbonic acid attachment, J. S. Halsey	199,436
Hose nozzle, C. H. Rodig	199,576
Hose to couplings, attaching, W. A. Caswell	199,350
Ice cream freezer, T. J. Soden	199,476
Indicator for boilers, A. W. Vandorston	199,598
Ingot mould stripper, T. James	199,553
Injector, S. Fowden	199,530
Japanning, M. Bray	199,504
Jewelry, W. Riker	199,580
Key retainer, J. W. Johnson	199,447
Knife scourer, A. E. McDonald	199,457
Ladder, A. R. W. Knight	199,556
Ladder, G. Carlton	199,514
Lamp, W. H. Garlick	199,532
Lamp, J. F. Rose	199,578
Lamp, C. Robinson	199,575
Land roller, R. W. Bunting	199,508
Land roller, W. Gutenberger	199,536
Lapping machine, H. N. Range	199,379
Latch, reversible, C. H. Labelle	199,452
Lathe, gauge, E. Silver	199,584
Lock for valises, chain, J. R. Rheubottom	199,468
Lock, time, M. A. Dalton	199,520
Lock, time, L. C. & S. M. Lillie	199,454
Lubricating device, F. B. Walton	199,602
Mail bag catcher, J. A. Boals	199,499
Marble, ornamenting, G. Hubmann	199,366
Marquetry, J. Dill	199,522
Mashing, G. Ellenberger (r)	8,050
Match safe and lamp, C. Jacobi	199,444
Metals, separating molten, F. J. Seymour	199,475
Middlings, preparing and treating, F. Wegmann	199,605
Millstones, C. P. Kemmerer	199,371
Millstones, W. Steele	199,591
Mortar, black, C. A. Didden	199,420
Mosquito net frame, H. Nyvall	199,566
Motor, spring, J. Schreiber	199,470
Nut blanks, machine for, G. B. Hill	199,546
Ore jigger, S. Bradley	199,502
Organ action, L. K. Fuller	199,429
Paper, folding and counting, N. S. Clement	199,354
Paper machine, J. Dunbar	199,359
Paper panels, C. Hansen	199,435
Paper pulp from salt water plants, W. E. Farrell	199,427
Pavement, I. Merchant	199,562
Pen, marking, J. Schneider	199,471
Pencil sharpener, W. H. Keys	199,448
Photographic plate holder, B. F. Baltzley	199,491
Photographic vignetting device, Price & Campbell	199,466
Piano hammer, A. O. Hall	199,587
Picture frames, clamping, M. Rose	199,579
Pin, safety, W. A. Butler	199,511
Pins, planing blanks for clothes, A. Hall, Jr.	199,364
Planter, E. L. Bergstresser	199,401
Planter, J. W. Fawkes (r)	8,054
Planter, E. R. Carr	199,410
Planter, J. L. Wright	199,485
Plow, E. H. Babcock *et al*	199,398
Plow, F. A. Barrows	199,493
Plow, L. J. Lowe	199,558
Plow, E. Yeiser	199,608
Plow, C. L. Jackson	199,443
Press, baling, W. H. Burgess	199,509
Press, cotton and hay, G. Ertel	199,360
Press, fuel, N. Aldrich	199,394
Propeller, E. J. Hulbert	199,549, 199,550
Pulley block, E. B. Beach	199,400
Pump, J. J. Stuart	199,596
Pump, force, W. F. Raymond	199,380
Pump, lubricating, E. G. Felthousen	199,428
Rail joint, H. W. Hammersmith	199,437
Railway signal, A. R. Swift	199,384
Railway signal, F. L. Pope (r)	8,044, 8,045
Railway switch, D. Pollock	199,570
Rake, horse hay, W. Adriance	199,486
Rake, horse hay, W. Aldrich	199,487
Rake, horse hay, J. C. Holton	199,440
Rawhides, boarding or breaking, W. Coupe	199,415
Rivet-setting machine, M. Bray	199,503
Rolling metal bars, S. Trethewey	199,482
Rolling metals, D. Jones	199,368
Rolling mill, C. H. Morgan	199,459
Rowing machine, G. Goldie	199,432
Rubber article, Dunbar & Lothrop (r)	8,043
Ruler, G. Soltmann	199,588
Safe, D. O. Paige	199,567
Satchel handle, G. Havell (r)	8,051
Saw-filing machine, O. W. Le Mar	199,453
Saw mill dog, B. D. Whitney	199,387
Saw mill head block, B. D. Whitney	199,386
Scales, platform, W. B. Daniels	199,356
Screen, window, C. Matheny	199,560
Screw-cutting die holder, J. F. Brinckmann	199,408
Sewing machine, straw braid, C. F. Bosworth	199,500
Shearing machine, R. T. Smith (r)	8,052
Shutter, A. Bijur	199,402
Sifter, ash, A. B. Kingsbury	199,449
Sink trap, J. H. Codding	199,413
Sled propeller, J. B. Erwin	199,361
Spark arrester, A. O. Denio	199,521
Spinning ring, J. W. Wattles	199,604
Spring, door, H. C. Steinhoff	199,383
Square and protractor, E. Ericson	199,425
Stall, horse, J. H. Clark	199,411
Stamp, hand, W. T. Morgans	199,460
Steam, absorbing the noise of, G. H. Buzzell	199,512
Stove, car, F. C. Conley	199,414
Stove, oil, P. Martin	199,456
Stove pipe thimble, Dixon & Unverferth	199,423
Stove polish liquid, G. G. Briggs	199,407
Stove, S. S. Jewett	199,446
Stove, A. Freeman	199,531
Stove, J. B. Andrews	199,396
Stove, W. A. King	199,555
Syringe, B. F. Sutton	199,479
Table and clothes horse, D. M. Singer	199,585
Tacks, making lasting, T. B. Cox	199,416
Telegraph wires, insulating, D. Brooks	199,506
Thermometer, J. S. F. Huddleston	199,442
Time signal, J. A. De Macedo	199,419
Tinware, I. F. Kearns	199,370
Tobacco-drying machine, W. B. Isaacs	199,367
Tongs, pipe, G. A. Harbaugh	199,539
Top-spinning device, E. D. Mackintosh	199,559
Transom lifter, J. H. R. Prall	199,465
Transplanting tool, J. C. Bowman	199,501
Treadle motion, Woodbridge & Gerlach	199,484
Tree protector, H. R. Daggett	199,355
Truck, R. Kent	199,372
Truss and supporter, A. M. Dye	199,424
Tug and attachment, J. D. Blinco	199,498
Type-writing machine, W. J. Barron	199,494
Type-writing machine, C. L. Sholes	199,382
Valve gear, Tifft & Love (r)	8,047
Vehicle body, K. A. Hughson	199,548
Vehicle seat, T. J. Hickey	199,545
Velocipede, A. M. Buchanan	199,409
Velocipede, J. A. Crandall	199,518
Ventilating cars and ships, J. M. Keating	199,554
Ventilator, H. M. Farnam	199,426
Ventilator and chimney cap, J. Walker	199,599
Ventilator for windows, L. D. Harvey	199,438
Vise, Cook & Hall	199,517
Wagon standard, J. Hobbs	199,439
Washboard, F. L. Wilson	199,607
Washstand, W. E. Buser	199,510
Washing machine, W. & A. E. Robarts	199,467
Washing machine, Wantz & Strasbough	199,603
Washing machine, C. A. Dodge	199,358
Watch guard tip, C. E. Hayward	199,365
Watches, potance for, C. V. Woerd	199,392
Water closet, ship's, J. E. Jones	199,369
Water closet valve, J. Demarest	199,418
Water closet, J. Sargent	199,582
Water meter, H. Chandler	199,351, 199,352
Water wheel, D. Cushman (r)	8,049
Wells, working, H. M. Gillespie	199,533
Wells, ram for, A. Alexander	199,488
Wheel, J. H. Moss	199,563
Whip socket, A. H. Law	199,374
Winding and reeling, W. L. Bright *et al*	199,348
Windmill, T. N. Shephard	199,473
Window frame, M. Casey	199,515
Wire-barbing machine, T. B. Doolittle	199,524
Wrench and saw set, J. Backer	199,489
Yoke, neck, J. Heimerl	199,543

[A copy of any of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.]

THE

Scientific American.

The Most Popular Scientific Paper in the World.

THIRTY-THIRD YEAR.

Only $3.20 a Year including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,

37 Park Row, New York.

The Postal Union.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

© 1878 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion ---75 cents a line.
Back Page, each insertion----$1.00 a line
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

Founded by Mathew Carey, 1785.

BAIRD'S BOOKS

FOR PRACTICAL MEN.

To our business of Industrial Publishers, we have added that of Industrial Booksellers and Importers, and have now on hand a valuable stock of ENGLISH and AMERICAN PRACTICAL AND SCIENTIFIC BOOKS, including the most recent issues from the English and American press.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS—96 pages, 8vo.—sent free to any one who will furnish his address.

☞ A Select list of Books on Metals, Metallurgy, Strength of Materials, Chemical Analysis, etc.; also, one on Steam and the Steam-Engine, as well as a Catalogue of a choice Collection of Practical, Scientific and Economic Books, with prices, sent free upon application.

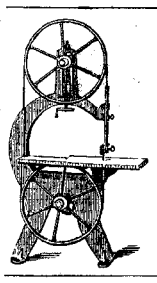
HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS,
810 WALNUT STREET, Philadelphia.

LOFTS TO LET,
WITH STEAM POWER.

Two Lofts, 35x175 ft. each; light on both sides and ends, with elevator, yard and stable room.

Desirable location; all the conveniences adapted to any manufacturing purposes where good light is required. Apply on the premises.

GEO. W. READ & CO.,
200 Lewis St., foot 5th & 6th Sts., E. R.



THE
Eureka Band Saw.

In constructing this machine, we have aimed to make it as simple in its construction as was consistent, and have all the necessary parts of a complete Band Saw. We have succeeded in producin a good and substantial saw at the unprecedented low price of $100. For further particulars, address

FRANK & CO.,
176 Terrace St., Buffalo, N. Y.

BREAD FOR WORKING MEN.

How can it be secured?

"The Labor Problem in the United States,"

by the Editor of a prominent New York Journal, ANSWERS THE QUESTION. Highly endorsed by the Rt. Hon. John Bright, Thurlow Weed, Mr. Scrimgeour, David A. Wells, Bishop Littlejohn, and *all who have read it.*

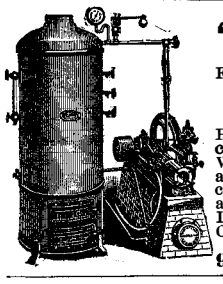
Every working man should read it. Paper covers, 75c. ATHENEUM PUBLISHING HOUSE, 100 Nassau St.

THE DINGEE & CONARD CO'S
BEAUTIFUL EVER-BLOOMING
ROSES

We deliver **Strong Pot Roses,** *suitable for immediate flowering*, safely by mail, at all post-offices. **5 Splendid Varieties,** *your choice*, all labeled, for **$1**; **12** for **$2**; **19** for **$3**; **26** for **$4**; **35** for **$5**; **75** for **$10**; **100** for **$13**. Send for our **NEW GUIDE TO ROSE CULTURE,** and choose from over **500** finest sorts. Our **Great Specialty** *is growing and distributing Roses.* THE DINGEE & CONARD CO., *Rose-Growers*, West Grove, Chester Co., Pa.

I HAVE INVENTED A SUCCESSFUL
Cotton Picker. Half interest offered for means to get a patent, etc. For full particulars, address
J. H. SMITH, Monticello, Arkansas.

FORCE OF WIND. HOW TO ESTIMATE
the Necessary Strength of Roofs, Towers, Tall Chimneys, etc., to withstand the Wind. The Solution of all Problems of the kind, with numerous Formula. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **109.** Price 10 cents. To be had at this office and of all newsdealers.



SNYDER'S "Little Giant" STEAM ENGINE.

For Farmers, Machinists, Printers, and all requiring Light Power.

Sizes from One to Six H. P. Prices for Engine and Boiler complete, from $150 to $450. We make the *Strongest Boiler* and the *Best Engine* in the country. Call at our Factory and examine, or send for free Illustrated and Descriptive Catalogue.

SNYDER BROS.,
94 Fulton St., New York.

THE SCIENCE of LIFE,
OR, SELF-PRESERVATION.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jeweled medal by the National Medical Association. It contains beautiful and very expensive steel plate engravings, and more than 50 valuable prescriptions for all forms of prevailing diseases, the result of many years of extensive and successful practice. 300 pages, bound in French cloth; price only $1, sent by mail. The London Lancet says: "No person should be without this valuable book. The author is a noble benefactor." An illustrated sample sent to all on receipt of 6 cents for postage. Address DR. W. H. PARKER, 4 Bulfinch St., Boston. The author may be consulted on all diseases requiring skill and experience.

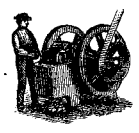
Smith's Manual of Telegraphy, 1878,
WITH TELEPHONE SUPPLEMENT,

Contains complete description of *The Telephone* in its perfected shape, with illustrations and instructions. The 5 different parts of this most simple and beautiful apparatus are herein shown in full size and correct measurement, so that any one may easily understand the construction and operation of **The Telephone.** *Price 30 cents, by mail*, postpaid.

L. G. TILLOTSON & CO., 8 Dey St., New York.

Telegraph and Electrical Apparatus and Material of every description. *Wire, Insulators*, and materials for **Telephone Lines.** Fine Silk-covered Wire and other materials for *Telephone Experiments* always in stock.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.



For breaking hard and brittle substances to any size. Endorsed by the leading **Mining, Manufacturing,** and **Railroad** corporations in the **United States** and **Foreign Countries. First Premium** wherever exhibited, and hundreds of testimonials of the *highest character.*

A NEW SIZE FOR PROSPECTING AND LABORATORY USE.

☞ ALL STONE CRUSHERS not made or licensed by us, containing vibratory convergent jaws actuated by a revolving shaft and fly-wheel, are infrin ements on our patent, and makers and users of such will be held accountable. Address

BLAKE CRUSHER CO., New Haven, Conn.

WORK FOR ALL

In their own localities, canvassing for the **Fireside Visitor,** (enlarged) Weekly and Monthly. **Largest Paper in the World,** with Mammoth Chromos Free Big Commissions to Agents. Terms and Outfit Free. Address **P. O. VICKERY, Augusta, Maine.**

GOLD
WATCH and CHAIN ONLY **$20** *Cheapest in the World!* Sample WATCH and CHAIN *FREE* to Agents. C. M. LININGTON, 47 Jackson St., Chicago.

THE DRIVEN WELL.

Town and County privileges for making **Driven Wells** and selling Licenses under the established **American Driven Well Patent,** leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
NEW YORK.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

Brainerd MILLING MACHINES,
all styles and sizes. Universal, Index, Gear Cutting, and Plain. Screw Machines and Vises. Address, for illustrated circular and prices, B. M. M. CO., 131 Milk St., Boston, Mass.

$100
PER MONTH and EXPENSES or Commission to a few good men to sell our TEAS to DEALERS. NO PEDDLING. C. A. LONG & CO., Nos. 4 & 5 Fuller Block, Dearborn Street, Chicago, Ill. **YEARLY Contract**

PATENTS SOLD.

For terms, address EUROPEAN and UNITED STATES PATENT EXCHANGE, 200 Broadway, N. Y. Box 2801.

WROUGHT IRON BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa., Manufacturers of improved wrought iron Beams and Girders (patented).

The great fall which has taken place in the prices of Iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 52 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings—THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that were owners fully aware of the small difference which now exists between the use of Wood and Iron, that in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address

CARNEGIE, BROS. & CO., Pittsburgh, Pa.

WANTED
SALESMEN for a wholesale house. Liberal salary; traveling expenses paid. Address R. & Co., box 1364, Cincinnati, Ohio.

$1200
Salary. Salesmen wanted to sell our Staple Goods to dealers. No peddling. **Expenses** paid. Permanent employment. address S. A. GRANT & CO., 2, 4, 6 & 8 Home St., Cincinnati, O.

Lathes, Planers, Shapers
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

BIG
84-page Picture Book, **free.** My plan beats all to make money. Is easy, honest, and pays you $10 a day. DAVID C. COOK, Chicago, Ill.

CHEAP HOUSEHOLD ORNAMENTS.

By GEO. M. HOPKINS. Practical Directions, with 13 illustrations, for making numerous Ornamental Objects with the simplest Tools and Materials. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **112.** Price 10 cents. To be had at this office and of all newsdealers.

!!New and Improved!! Engraving Process!!!!
Perfect Substitute for Wood-Cuts.

Photo-Plate Company
63 Duane St. New York.

Can be printed on an ordinary Press.

RELIEF PLATES in hard Type Metal for Newspaper & Book Illustration.

Send Stamp for Illustrated Circular.

MUCH CHEAPER THAN WOODCUTS

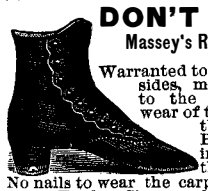
State where you saw this.

B. WESTERMANN & CO., New York,
Have just published a new edition of their
SCIENTIFIC CATALOGUE,
Containing the latest and most prominent
German, French, English & American Books
ON
Natural Sciences, Physics, Chemistry, Photography, Pharmacy, Mathematics, Astronomy, Mining, Metallurgy, Civil Engineering, Architecture, Technology, Commerce, Agriculture and Horticulture.

36 Pages Octavo. Price 15 cents, refunded on receipt of orders.

There is no similar Catalogue giving, like the above, a Synoptic List of the leading Publications in all the three languages on the different branches of Science.

B. WESTERMANN & CO.,
Foreign Booksellers and Importers,
524 Broadway, New York.



DON'T FAIL TO USE
Massey's Revolving Shoe Heel Protector.

Warranted to wear the heel evenly on all sides, maintaining an upright tread to the Foot, and avoiding uneven wear of the Sole and Upper. It doubles the durability of Shoes and Boots, saves expense of reheeling, is *Noiseless*, does not Tire the Foot, and does not Slip. No nails to wear the carpet. Can be attached by any one. Twelve Sizes made, suitable for all Shoes and Boots. Samples, with Tool and Directions for applying, sent postpaid, on receipt of 50 cents. Liberal discounts to the Trade. N.B.—In ordering, send width of heel for proper size. Address

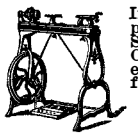
MASSEY REVOLVING SHOE HEEL CO.,
824 Broadway, New York.

Pond's Tools,
Engine Lathes, Planers, Drills, &c.
Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND. **Worcester, Mass.**

$3
GOLD PLATED WATCHES. Cheapest in the known world. *Sample Watch Free to Agents.* Address, A. COULTER & Co., Chicago.

65
MIXED CARDS, with name, 10c. and stamp. Agent's Outfit, 10c L. C. COE & CO., Bristol, Ct.

EAGLE FOOT LATHES,



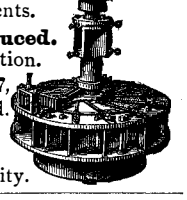
Improvement in style. Reduction in prices April 20th. Small Engine Lathes, Slide Rests, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outfits for Amateurs or Artisans.

WM. L. CHASE & CO.,
95 & 97 Liberty St., New York.

IMPORTANT FOR ALL CORPORATIONS AND MANF'G CONCERNS.—**Buerk's Watchman's Time Detector,** capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.
J. E. BUERK, P.O. Box 979, Boston, Mass.
N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. A fine was assessed against them Nov. 11, 1876, for selling contrary to the order of the court. Persons buying or using clocks infringing on my patent will be dealt with according to law.

Anderson's Safety Inkstand.—Don't spill, spoil pens, or soil fingers. Over 150,000 sold. Sent in exchange for old books, or *free* on easy conditions. Send postal card to *American Book Exchange*, 55 Beekman St., N. Y.

LEFFEL WATER WHEELS.



With recent improvements.
Prices Greatly Reduced.
7000 in successful operation.
FINE NEW PAMPHLET FOR 1877,
Sent free to those interested.
James Leffel & Co,
Springfield, O.
109 Liberty St., N, Y. City.

$2500
a year. Agents wanted everywhere. Business strictly legitimate. Particulars free Address J. WORTH & Co., St. Louis, Mo.

MINE ACCIDENTS. MECHANICAL AP-
pliances for use in case of Explosions, etc. By CHAS. HAWKSLEY and EDWARD B. MARTEN. A paper read before the Institution of Mechanical Engineers. Eighteen illustrations of the most approved apparatus for quickly discharging water from mines, promptly restoring Ventilation, etc., namely: the Pulsometer, the Steam Ejector, the Centrifugal and other Pumps, combined Boiler, Engine, and Air Compressor; Air Lock, and Portable Winding Gear. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 105. Price 10 cents. To be had at this office and of all newsdealers.

Wood-Working Machinery,
Such as Woodworth Planing, Tongueing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburgh, Pa.
190 S. Canal Street, Chicago, Ill., and Milwaukie, Wis.
☞ Stocks of this shafting in store and for sale by
FULLER, DANA & FITZ, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.

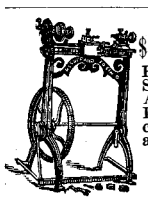
NEW UNITED STATES GOVERNMENT
Rules in Respect to Boilers, Boiler Inspection, Stamping and Testing of Boiler Plates, Fire Apparatus, and Boat Lowering Devices and Life Preservers. Instructions to Inspectors, and Tests of Boiler Material are to be made and recorded. Requirements in Construction of Boilers. The Law in full, with List of Approved Fire Extinguishing, Life Saving, and Boat-lowering Apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **113.** Price 10 cents. To be had at this office and of all newsdealers.

WANTED
—Men in each State for the Detective Service and to report crime. Pay liberal. Inclose stamp, and address AMERICAN AND EUROPEAN SECRET SERVICE CO., Cincinnati, Ohio.

FOR NEW ILLUSTRATED CATALOGUE OF FOOT Lathes, Scroll Saws, Small Steam Engines and Amateur's Tools, send stamp to Chase & Woodman, Newark, N. J.

The HOADLEY
PORTABLE STEAM ENGINE.
WITH AUTOMATICAL CUT-OFF REGULATOR AND BALANCED VALVE.
THE BEST AND MOST ECONOMICAL ENGINE MADE
SEND FOR CIRCULAR.
The J. C. HOADLEY CO. LAWRENCE, MASS.
STATE WHERE YOU SAW THIS.

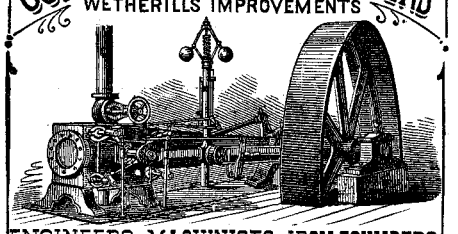
NOMENCLATURE OF BUILDING
Stones and Stone Masonry. By J. JAMES R. CROES, WILLIAM E. MERRILL, and EDGAR B. VAN WINKLE. A paper read before the American Society of Civil Engineers An exhaustive article on Stone Cutting and Masonry, various Methods of Dressing, and Tools employed, with 34 illustrations. 19 Tools, illustrated, with Dimensions and How to Make. Squared, Quarry-faced, Pitched-face, and Drafted Stones. Rubble, Cut, Pointed, and Crandalled Stones, etc. Axed or Pean Hammered and Patent Hammered Stones. Bush Hammered and Rubbed Stones. Diamond Panels. Rubble, Squared Stone, Range, Random, and Ashlar Masonry, 34 illustrations in all, with practical instructions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **113.** Price 10 cents. To be had at this office and of all newsdealers.



SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scroll, Circular and Band Saws, Saw Attachments, Chucks, Mandrills, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.

H. L. SHEPARD & CO.,
88, 90 & 92 Elm St.,
Cincinnati, Ohio.

CORLISS ENGINE BUILDERS
WITH
WETHERILLS IMPROVEMENTS



ENGINEERS, MACHINISTS, IRON FOUNDERS AND BOILER MAKERS.
ROBT. WETHERILL & CO.
CHESTER, PA.

STEAM PUMPS.
FIRST PRIZES, CENTENNIAL, PHILA., VIENNA, PARIS, NEW YORK, BALTIMORE, BOSTON.
Send for circular of recent patented improvements.
THE NORWALK IRON WORKS CO.,
Prices Reduced. South Norwalk, Conn

PROPOSALS
To Engineers, Builders, Contractors, Architects, Measurers, Artisans, etc.

The **ONLY** American Publication on
Engineering Specifications and Contracts.
By L. M. HAUPT, Prof. of Civil Engineering, University of Pennsylvania.

An Octavo Volume of 320 pages; cloth; **$3.**

CONTENTS.—Chap. I, Drawings; II, Estimates and Measurements of Artisan's Work, Specific Gravities, etc.; III, Specifications for River and Harbor Improvements, Municipal and Architectural Works, Railroad Graduation, Masonry and Superstructure, Bridges, Rails, Rolling Stock, etc.; IV, Advertisements; V, Proposals; VI, Contracts, Law of, with forms for the various Specifications previously given, Glossary of Technical Terms.

For sale by all booksellers, or mailed postpaid on receipt of the price by the publishers,
J. M. STODDART & CO., 723 Chestnut St., Phila.

VERTICAL SCIENTIFIC GRAIN
Mills and Black Diamond Mill Picks are our specialties. Before purchasing elsewhere send for price list.

A. W. STRAUB & CO.,
2231 Wood St., Philadelphia, Pa.

SCROLL SAWYERS SEND FOR TWO
elegant illustrated design lists. Swiss saw blades per doz., 10c. *Best German, only* 15c. Agent new Lester Saw. C. H. PARKER, Coldbrook Springs, Mass.

$8
YOUNG AMERICA SCROLL SAW beats the world. J. M. BEUGLER, M'f'r, Williamsport, Pa.

IMPORTANT TO
Yarn and Cotton Goods Dyers, Calico Printers, and Manufacturing Chemists.

A new, very short, safe, cheap, easy, and practical way of dyeing Turkey Red and other fast colors on Cotton fibres, by a practical yarn and piece Turkey Red dyer of long experience. How to make the preparation to use it, and for terms, apply to CHARLES H. SIEBER, 64 Corporation Street, Manchester, England.

RISDON'S IMPROVED TURBINE WATER WHEEL
Yielded at the test of Turbines at Centennial Exposition the best results at all stages of gate. Send for circular to

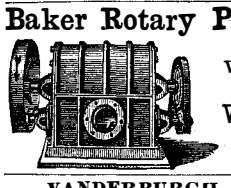
T. H. RISDON & CO.,
Mt. Holly, N. J.
Manufacturers of MILL MACHINERY.

$100 SAVED.
Send for receipt to make composition rouge; also, information given for *electro* solutions. By inclosing $1 a receipt will be given and warranted. Address
BYRON & PETERS, 853 Seventh Ave., N. Y. city.

WEATHERBOARD GAUGE AND REST, PATENT of Aug. 4th, 1868, for sale, or will be exchanged for land. Address J. A. WILLIAMS, Westfield, Ind.

THE HYDRAULIC RAM. HISTORY OF
its invention. The latest improvements and working of the Ram; most successful Dimensions, Valve-seats, etc. Fischer's Ram, and others. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **111.** Price 10 cents. To be had at this office and of all newsdealers.

Baker Rotary Pressure Blower.



(FORCED BLAST)
Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA.

VANDERBURGH, WELLS & CO.,
18 Dutch St., N. Y., cor. Fulton. ENGRAVERS' BOXWOOD, MACHINISTS' PATTERNS & BRAND LETTERS.

BIG PAY
to sell our Rubber Printing Stamps. Samples free. Taylor Bros. & Co., Cleveland, O.

EPILEPSY or FITS CURED!
by Dr. Ross' Epileptic Remedies. TRIAL PACKAGE SENT FREE. Cures speedy, absolute and permanent. Address ROSS BROS., No. 512 Main St., RICHMOND, IND.

TO EXPORTERS.
The undersigned are in position to introduce successfully into Great Britain all products of American manufacture and useful inventions; also to fill, on the best terms, orders for English goods generally for the American market. Any information desired is furnished by return mail free of charge.

L. COLANGE & CO.,
19 Great St., Helens, London, E. C.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N. Y. who control the patent for Green's American Driven Well.

PATENT MINERAL WOOL.
Incombustible. The best non-conductor. For illustrated description see SCIENTIFIC AMERICAN of January 12th
A. D. ELBERS,
P. O. Box 4461. 26½ Broadway, N. Y.

50
Best Mixed Cards, with name, in case, 13c., or 25 no 2 alike, 10c. Outfit 10c. Dowd & Co., Bristol, Ct.

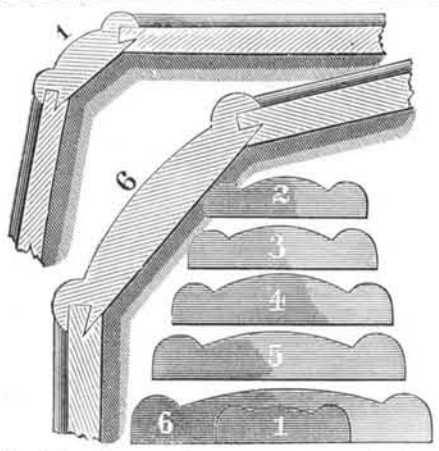
JENNINGS' WATER CLOSETS
PRICES REDUCED SEND FOR CIRCULAR
94 BEEKMAN STREET NEW YORK

© 1878 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

Every Man His Own Printer! A $3 Excelsior Portable Press will print cards, labels, etc., at *quarter* printer's prices. Large press, for circulars, etc., $9. Send two 3c. stamps for catalogue.
KELSEY & CO., M'f'rs, Meriden, Conn.



Drake's Corner for Coffins and Caskets.
The annexed engraving exhibits a new corner for coffins or caskets, which is strong, easily applied, ornamental, and is productive of considerable economy in price. No. 1 represents foot end of smallest coffin, and No. 6 that of the largest sized casket, the relative sizes showing the proportions. Nos. 2, 3, 4, and 5 represent intermediate sizes. The corner is offered to manufacturers at a moderate royalty per coffin or casket. It will be found indispensable to all who once use it. Address the patentee, LEWIS W. DRAKE, Hazelton, Pa.

Jarvis Gas Consuming Furnace.
For Setting Steam Boilers. Will burn screenings with small mixture of soft coal without blower, also *green wet peat*. Three boilers set this way will make as much steam as five old way. Address A. F. UPTON, Agent, Boston, Mass.

Steel Castings,
From ¼ to 10,000 lbs. weight, true to pattern. An invaluable substitute for forgings, or for malleable iron castings requiring great strength. Send for circular and price list to CHESTER STEEL CASTING COMPANY, EVELINA STREET, PHILADELPHIA, PA.

CAVEATS, COPYRIGHTS, TRADE MARKS, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Trade Mark Regulations, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Trade Marks, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents, sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.
BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

Harrison's System of Grinding!
Illustrated Catalogue Now Ready.
NEW STANDARD FLOURING MILLS.
Old Theories, Horizontal Grinders, Slow Runners, Fully Exploded. Fine Flour, High Speed, and Economical Milling Fully Established.
A NEW Copy For All.
Millers and Editors please address
EDWARD HARRISON,
No. 135 Howard Ave. New Haven, Conn.

Steel Name Stamps.
N. Y. STENCIL WORKS, 87 Nassau St., N. Y.

25 NEW YEAR CARDS, with name, 20c. **25** Extra Mixed, 10c. Geo. I. Reed & Co., Nassau, N.Y.

H. R. WORTHINGTON,
239 BROADWAY, NEW YORK.
Hydraulic Works, Van Brunt Street, Brooklyn, Manufactures Pumping Engines for Water Works. In daily use at 100 stations. Also Steam Pumps, Water Motors and Water Meters. See SCIENTIFIC AMERICAN SUPPLEMENT, January 27th, 1877. Prices largely reduced July 1ts, 1877.

ADVERTISERS SELDOM FAIL TO MAKE MONEY
When their advertising is properly placed.
For list of best mediums, address
EDWIN ALDEN'S ADVERTISING AGENCY,
174 ELM STREET, CINCINNATI, O.
Best rates in the best papers.
Send for catalogue. Estimates and information free.

TUNNELS AND ROCK-BORING MACHINERY. By John Darlington. Particulars, Dimensions, and Methods employed in the Mont Cenis, St. Gothard, Hoosac. Sutro, Musconetcong, and Severn Tunnels. Rapidity of Work, Performances and Cost of Various Machines, Amount of Water, Compressed Air, etc., required, and nine illustrations. The Altenberg Zinc Mines, Aix-la-Chapelle; Perseberg Mines, Sweden; Shaft at Salzberg Altenwald; Marie Colliery; Pierre Dennis Pit; Stahlberg Musen, Prussia; Gouley Colliery; Dryrook Iron Mines; Sir Francis Level, Yorkshire; Frederichsegen Wrexam Mineral Mines; Johann Colliery, Prussia; Maesteg Tunnel; Cymbran; Dolcoath; South Crofty, Cornwall; Carn Brea, Cornwall; Ballacorkish, Isle of Man. For each Mine or Tunnel is given the Number of Holes in Heading, Character of Rock, Labor Employed, Time, Cost, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **109.** Price 10 cents. To be had at this office and of all newsdealers.

FRIEDMANN'S PATENT
INJECTORS and EJECTORS
Are the Most Reliable and Economical
BOILER FEEDERS
And Water Conveyors
IN EXISTENCE.
MANUFACTURED EXCLUSIVELY BY
NATHAN & DREYFUS,
NEW YORK.
Also Patent Oilers and Lubricators.
Send for Catalogue.

PATENTS AT AUCTION.
Regular Monthly Sales the first week of each month by George W. Keeler, Auctioneer, at his salesrooms, 53 Liberty Street, N. Y. For terms, etc., address The New York Patent Exchange, Room 11, 55 Liberty Street.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

Patent Atmospheric Gas Burner,
for softening paint with Gas. One man removing two square feet of paint in one minute. The ONLY BURNER that will burn with its mouth downward and not heat back.
A. H. WATKINS, 294 Harrison Ave., Boston, Mass.
*** Send for Circular with Testimonials.

YALE VERTICAL MILL
Iron Frame; French Burr; Self-oiling; Self-feeding; Long Bearings; Adjustable-balanced; best arranged, made and finished, *cheapest*, and for quality and quantity ground no superior in the world. Also the Yale Vertical and Horizontal Steam Engines and Boilers. Send for Circular.
FOR SALE.—1 Heavy 20 in. Harrison Vertical Mill, $160. 1 Extra Heavy 24 in. Harrison Vertical Mill, $225.
YALE IRON WORKS, New Haven, Conn.

ESTABLISHED 1844.
JOSEPH C. TODD,
(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. I also manufacture Baxter's New Portable Engine of 1877, of one horse power, complete for $125; can be seen in operation at my store. I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address
J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

W. W. SHARPE & CO.,
ADVERTISING AGENTS
25 PARK ROW, NEW YORK.
Advertisements written, appropriately displayed, and proofs, with estimated cost in any number of papers, furnished free of charge. The leading Newspapers kept on file for the accommodation and inspection of Advertisers.

ICE AT $1.00 PER TON.
The PICTET ARTIFICIAL ICE CO.,
LIMITED,
Room 51, Coal and Iron Exchange, P. O. Box 3083, N. Y

TO ADVERTISERS! We will send free to all applicants who do any newspaper advertising, the THIRD EDITION of
AYER & SON'S MANUAL
FOR ADVERTISERS. 160 8vo. pp. More complete than any which have preceded it. Gives the names, circulation, and advertising rates of several thousand newspapers in the United States and Canada, and contains more information of value to an advertiser than can be found in any other publication. All lists have been carefully revised, and where practicable prices have been reduced. The special offers are numerous and unusually advantageous. Be sure to send for it before spending any money in newspaper advertising. Address N. W. AYER & SON, ADVERTISING AGENTS, Times Building, Philadelphia.

Cut Brass Gears, list free. Grant, 194 Beverly St., Boston.

ROCK DRILLING MACHINES AND AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET FITCHBURG, MASS.

Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

WATSON'S NON CHANGEABLE GAP LATHE HAS GREAT FACILITIES FOR LARGE OR MEDIUM SIZE WORK. JAMES WATSON MANF'R 1608 S. FRONT ST. PHILA PA.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

MECHANICAL DRAWING.—BY PROF. C. W. MacCord. A series of practical lessons in Mechanical Drawing, accompanied by carefully prepared examples for practice, with directions, all of simple and plain character, intended to enable any person, young or old, skilled or unskilled, to acquire the art of drawing. No expensive instruments are involved. Any person with slate or paper may rapidly learn. The series embodies the most abundant illustrations for all descriptions of drawing, and forms *the most valuable treatise upon the subject ever published, as well as the cheapest.* These instructions are contained in SUPPLEMENTS Nos. **1, 3, 4, 6, 8, 9, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46 47, 48.** Price 10 cts. each; or, $3 for the entire series of thirty-three numbers. To be had at this office and of all newsdealers.

P. BLAISDELL & CO.,
Worcester, Mass.,
Manufacturers of the Blaisdell Patent Upright Drills and other first-class Machinists' Tools.

PUNCHING PRESSES. Drop Hammers and Dies, for working Metals, &c. THE STILES & PARKER PRESS CO., Middletown, Conn.

Bound Volumes
OF THE
Scientific American.
At present, I have on hand the following **bound** Volumes of the SCIENTIFIC AMERICAN, which I will sell at $1.00 each, either singly or by the quantity.

OLD SERIES.	NEW SERIES.	NEW SERIES.
Vol. 6....3 Copies.	Vol. 1... 6 Copies.	Vol. 15.. 9 Copies.
" 7....4 "	" 2... 7 "	" 16..10 "
" 11....5 "	" 3... 4 "	" 28..10 "
" 13....4 "	" 4... 7 "	" 32..18 "
" 14....1 "	" 7... 3 "	
	" 8... 5 "	
	" 9... 5 "	
Vols. of the Old Series contain one year's numbers, and the New Series six months.	" 10...11 "	
	" 11... 4 "	
	" 12...11 "	
	" 13...11 "	
	" 14... 9 "	

The books will be sent by express on receipt of price. Address all communications to
JOHN EDWARDS,
P. O. Box 773, New York.

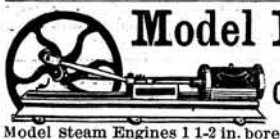
25 EXTRA NEW YEAR CARDS, with 20 cts. Samples 3c. J. B. HUSTED, NASSAU, N. Y.

Boult's Patent Reverse Motion

Paneling, Variety Moulding & Dovetailing Machine. Cuts Panels of any design or style of mould in the solid wood with neatness and dispatch.
Is a first-class Shaper, Edge, & Scroll Moulder. Does general Dovetailing with thick or thin stuffs. **Simple, Durable and Efficient.** Send for Pamphlet and Sample of work. Improved Solid Steel Cutters for all kinds of Variety Moulders made to order, and warranted by the
B. C. MACHINERY CO.,
Battle Creek, Mich.

PERFECT
NEWSPAPER FILE
The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
GEO. PLACE, 121 Chambers St., New York Agent.



Model Engines.
Complete sets of **CASTINGS** for making small Model Steam Engines 1 1-2 in. bore, 3 in. stroke, price, $4; ditto 2 in. bore, 4 in. stroke, price, $10, same style as cut. Eureka Foot Lathes only 15 Dollars. Gear Wheels and Parts of Models. All kinds of Small Tools and Materials Illustrated Catalogue Free.
GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass

THE RAILROADER, TOLEDO, O., A HANDSOME 16-page monthly, devoted to the interests of railroad employees of every branch of service. Subscription $1 a year. Send for a specimen copy.

DYKES' BEARD ELIXIR HAS done it, and will do it on the smoothest face More than 20,000 young men already wear HEAVY MOUSTACHE AND BEARD, having used from 1 to 3 Pack'gs. No injury. Easily applied. Certain in effect. Package with directions post-paid 25 cts. 3 for 50 cts. SMITH & CO., Sole Agents, Palatine, Ill. This preparation is imitated. The public will use due caution and Address as above.

1874, 1875,
SCIENCE RECORD.
A few copies of these splendid books are offered at the following very low prices.
Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:
CHEMISTRY AND METALLURGY,
MECHANICS AND ENGINEERING,
ELECTRICITY, LIGHT, HEAT, SOUND.
TECHNOLOGY, THE USEFUL ARTS,
BOTANY AND HORTICULTURE,
AGRICULTURE,
RURAL AND HOUSEHOLD ECONOMY,
MATERIA MEDICA, THERAPEUTICS, HYGIENE,
NATURAL HISTORY AND ZOOLOGY,
METEOROLOGY, TERRESTRIAL PHYSICS,
GEOGRAPHY,
GEOLOGY AND MINERALOGY,
ASTRONOMY,
BIOGRAPHY AND NECROLOGY.
Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of $1.25 each. Address
MUNN & CO., PUBLISHERS,
37 Park Row, New York city.

H. W. JOHNS' PATENT.
ASBESTOS MATERIALS.
Liquid Paints—all shades, finest in the world.
Fire Proof Paint, for Wood work, &c.
Roof Paint, for Tin Roofs, Iron Work, &c.
Roofing, with white Fire Proof Coating.
Roof Coating, for restoring and preserving old roofs.
Cements, for Retorts, Furnaces, Leaky Roofs, &c.
Steam Pipe and Boiler Coverings.
Steam Packing, Asbestos Boards, Fire Proof Coatings, Sheathings and Roofing Felts, &c.
These articles are ready for use, and can be easily applied by any one. Send for Samples, Pamphlets, Price Lists, &c.
H. W. JOHNS MANUFACTURING COMPANY,
87 Maiden Lane, New York.
Also for sale by
PHILADELPHIA BRANCH, 406 Arch St.
DOWNIE, TRAINER & CO., Boston.
S. W. HEMPSTED & CO., Columbus, Ohio.
M. M. BUCK & CO., St. Louis.
C. A. PARKER & CO., New Orleans.
THOMPSON & UPSON, San Francisco.

RAILWAY & MACHINISTS' SUPPLIES.
Pat. Lubricant, Bolts, Nuts, Washers, Lag Screws, Fan Blowers, Jack Screws, Packing, etc.
ALBERT BRIDGES, 46 Cortlandt St., N. Y.

BRADFORD MILL CO.
Successors to Jas. Bradford & Co.
MANUFACTURERS OF
French Buhr Millstones,
Portable Corn & Flour Mills,
Smut Machines, etc.
Also, dealers in Bolting Cloths and General Mill Furnishing.
Office & Factory, 158 W. 2d St.
CINCINNATI, O.
J. R. Stewart, *Pres.* W. R. Dunlap, *Sec.*
PRICE-LISTS SENT ON APPLICATION.

DANBURY DRILL CHUCKS.
Perfected and Price reduced.
Manuf'd by the HULL & BELDEN CO., Danbury, Ct.

OTIS' SAFETY HOISTING Machinery.
OTIS BROS. & CO., No. 348 Broadway, New York.

PATENT SCROLL AND BAND SAW MACHINES A speciality. CORDESMAN, EGAN & CO., Cincinnati, O.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
334 W. 29. ST. NEW YORK CITY

INTERNATIONAL EXHIBITION FOR Agricultural Machines and Implements, Hamburg, 1878. Under the auspices of the Section for Agriculture and Horticulture, and the Union of German Manufacturers and Dealers in Agricultural Machinery, an International Mart will be held in Hamburg from the 13th to the 17th of June next for the exhibition, etc., of agricultural machines and implements. Plans and instructions for sending exhibits to this international market can be obtained from the bureau of the committee, whose officers are announced herewith. Address Committee of the International Market for Agricultural Machines and Implements, A. B. C. strasse No. 25, Hamburg, Germany. ALBERT VON OHLENDORF, President; HERMANN SCHLEMMANN, Treasurer; Dr. RICHARD SEELEMANN, Recorder.

FREE TO ALL
D. M. FERRY & CO'S
ILLUSTRATED DESCRIPTIVE AND PRICED
SEED ANNUAL for 1878

Will be mailed FREE to all applicants. It contains colored plate, 500 engravings, about 150 pages, and full descriptions, prices and directions for planting over 1200 varieties of Vegetable and Flower Seeds, Plants, Roses, Etc. Invaluable to all. Send for it. Address
D. M. FERRY & CO., Detroit, Mich.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.

© 1878 SCIENTIFIC AMERICAN, INC